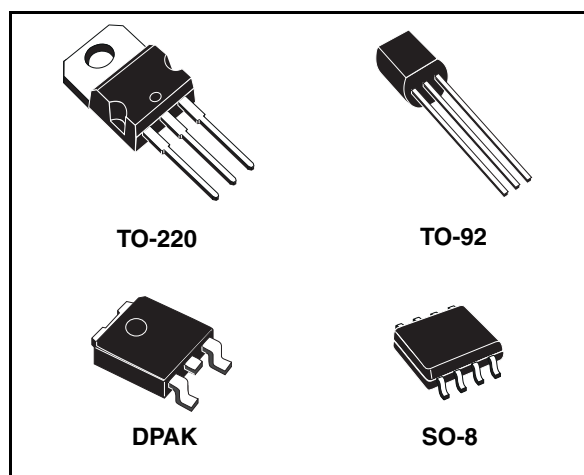


Very low drop voltage regulators with inhibit function

Feature summary

- Very low dropout voltage (0.15V typ. at 10mA load)
- Low quiescent current (typ. 2.5mA, at 100mA load)
- Output current up to 100mA
- Adjustable (from $V_{OUT} = 2.5V$ only SO-8) and fixed (3.3V & 5V) output voltage version
- Internal current and thermal limit
- Load dump protection up to 60V
- Reverse transient protection up to -50V
- Temperature range: -40 to 125°C
- Package available: TO-92, DPAK, TO-220, SO-8 (with inhibit control)



This means that when the device is used as a local regulator is possible to put a part of the board in stand-by decreasing the total power consumption. Ideal for automotive application the LM2931 is protected from reverse battery installations or 2 battery jumps. During the transient, such as a load dump (60V) when the input voltage can exceed the specified maximum operating input voltage (26V), the regulator will automatically shut down to protect both internal circuit and the load.

Description

The LM2931 series are very low drop regulators. The very low drop voltage and the low quiescent current make them particular suitable for low noise, low power applications and in battery powered systems. In the 8 pin configuration (SO-8), fully compatible to the older L78L00 family, a shut down Logic Control function is available.

Order codes

Part number					Output voltage
TO-220	DPAK	TO-92 (BAG)	TO-92 (Ammopak) (1)	SO-8	
LM2931AV33	LM2931ADT33R	LM2931AZ33R	LM2931AD33AP	LM2931AD33R	3.3 V
LM2931BV33	LM2931BDT33R	LM2931BZ33R	LM2931BD33AP	LM2931BD33R	3.3 V
LM2931AV50	LM2931ADT50R	LM2931AZ50R	LM2931AD50AP	LM2931AD50R	5.0 V
LM2931BV50	LM2931BDT50R	LM2931BZ50R	LM2931BD50AP	LM2931BD50R	5.0 V
				LM2931D-R	2.5 to 26 V

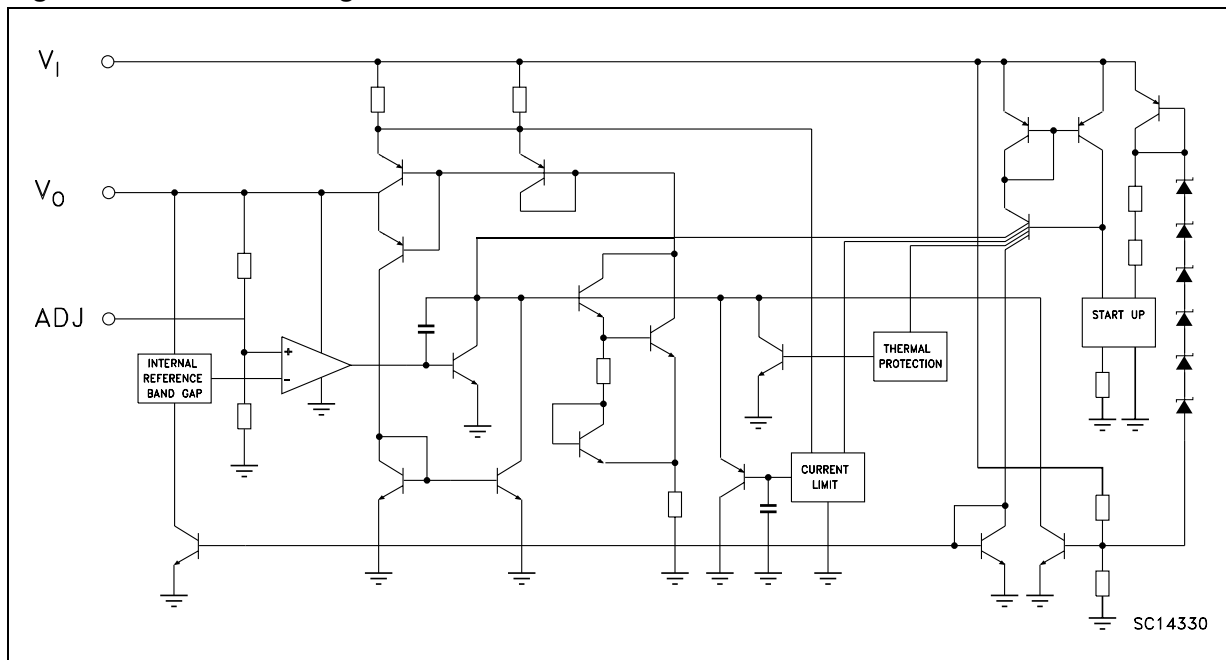
1. Please note that in these cases pins are shaped according to Tape & Reel specifications.

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3	Maximum ratings	5
4	Application circuits	6
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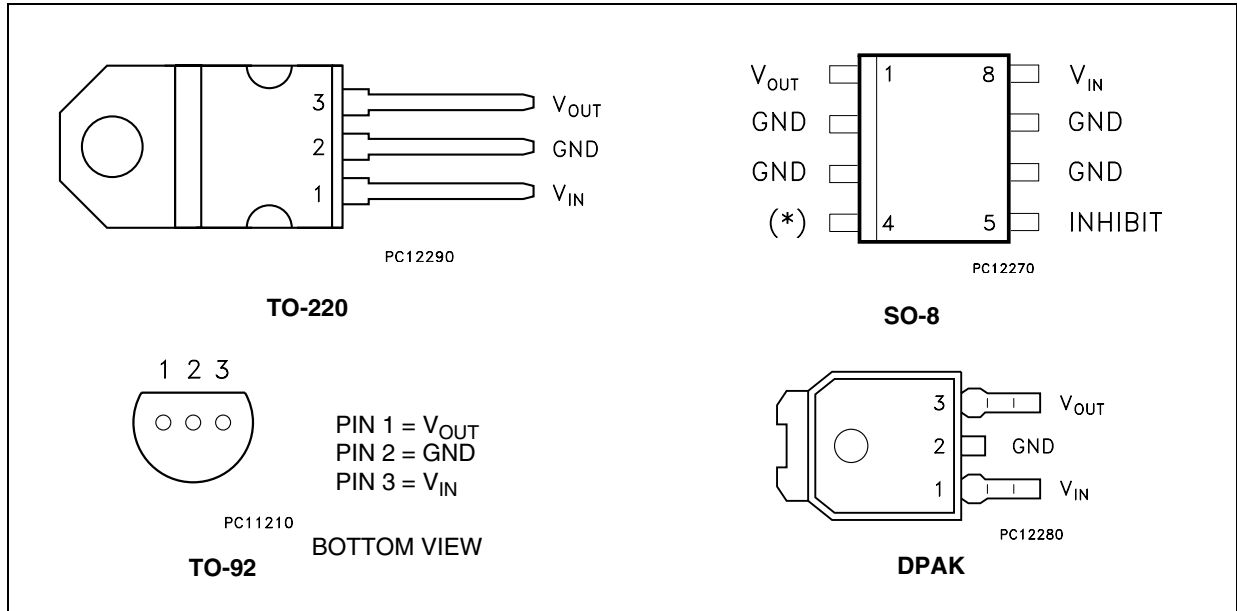
1 Diagram

Figure 1. Schematic diagram



2 Pin configuration

Figure 2. Pin connections (top view)



3 Maximum ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_I	DC Positive input voltage	40	V
V_I	DC Reverse input voltage	-15	V
V_I	Transient input voltage ($\tau < 100\text{ms}$)	60	V
V_I	Transient reverse input voltage ($\tau < 100\text{ms}$)	-50	V
V_{INH}	Inhibit input voltage	40	V
I_O	Output current	Internally Limited	
T_{STG}	Storage temperature range	-65 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-220	SO-8	DPAK	TO-92	Unit
R_{thJC}	Thermal resistance junction-case	3	20	8		°C/W
R_{thJA}	Thermal resistance junction-ambient	50	55 ⁽¹⁾	100	200	°C/W

1. Considering 6 cm² of copper board heat-sink.

4 Application circuits

Figure 3. Application circuits for fixed output

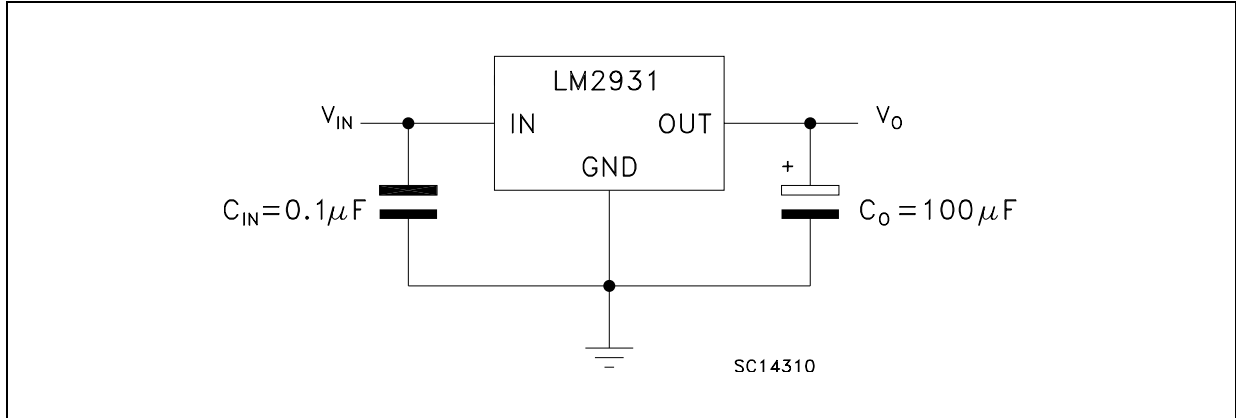
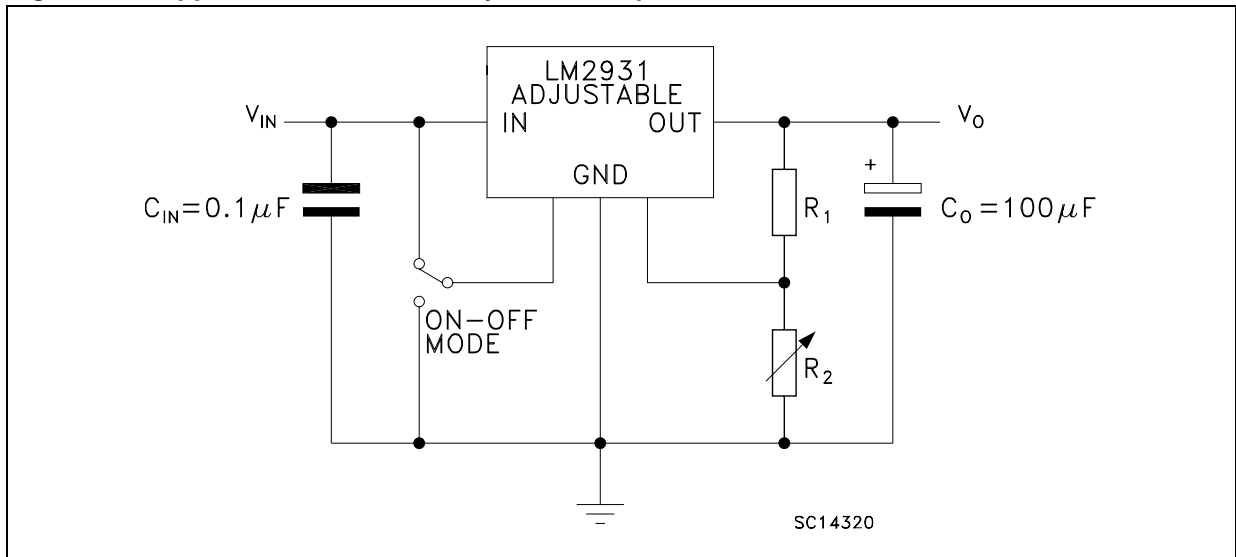


Figure 4. Application circuits for adjustable output



R_1 suggested value = 27K Ω

$$V_O = V_{REF} (R_1 + R_2) / R_1$$

5 Electrical characteristics

Table 3. Electrical characteristics of LM2931A 3.3V (refer to the test circuits, $T_J = 25^\circ\text{C}$, $C_I = 0.1 \mu\text{F}$, $C_O = 100 \mu\text{F}$, $V_I = 14\text{V}$, $I_O = 10\text{mA}$, $V_{INH} = 0\text{V}$, unless otherwise specified).

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_I	Maximum operating input voltage	$I_O = 10 \text{ mA}$, $T_J = -40 \text{ to } 125^\circ\text{C}$	26	37		V
V_O	Output voltage		3.135	3.3	3.425	V
V_O	Output voltage	$I_O = 100 \text{ mA}$, $V_I = 6 \text{ to } 26 \text{ V}$ $T_J = -40 \text{ to } 125^\circ\text{C}$	3.135	3.3	3.465	V
ΔV_O	Line regulation	$V_I = 9 \text{ to } 16 \text{ V}$		2	10	mV
		$V_I = 6 \text{ to } 26 \text{ V}$		4	33	
ΔV_O	Load regulation	$I_O = 5 \text{ to } 100 \text{ mA}$		10	33	mV
V_d	Dropout voltage ⁽¹⁾ ⁽²⁾	$I_O = 10 \text{ mA}$		90	250	mV
		$I_O = 100 \text{ mA}$		250	600	
I_d	Quiescent current ON MODE	$I_O = 100 \text{ mA}$		2.5	30	mA
	OFF MODE	$V_{INH} = 2.5 \text{ V}$, $R_{LOAD} = 330 \Omega$		0.3	1	mA
I_{SC}	Short circuit current		100	300		mA
SVR	Supply voltage rejection	$I_O = 100 \text{ mA}$, $V_I = 14 \pm 2 \text{ V}$ $f = 120 \text{ Hz}$, $T_J = -40 \text{ to } 125^\circ\text{C}$	55	78		dB
V_{IL}	Control input voltage low	$T_J = -40 \text{ to } 125^\circ\text{C}$		2	1.2	V
V_{IH}	Control input voltage high	$T_J = -40 \text{ to } 125^\circ\text{C}$	3.25	2		V
I_{INH}	Inhibit input current	$V_{INH} = 2.5 \text{ V}$		22	50	μA
V_I	Transient input voltage	$R_{LOAD} = 330 \Omega$, $\tau < 100\text{ms}$	60	70		V
V_I	Reverse polarity input voltage	$V_O = \pm 0.3 \text{ V}$, $R_{LOAD} = 330 \Omega$	-15	-50		V
V_I	Reverse polarity input voltage transient	$R_{LOAD} = 330 \Omega$, $\tau < 100\text{ms}$	-50			V
eN	Output noise voltage	$B = 10 \text{ Hz to } 100 \text{ KHz}$		330		μV_{RMS}

1. Reference Voltage is measured from V_{OUT} to ADJ pin.

2. V_d measured when the output voltage has dropped 100mV from the nominal value obtained at 14V.

Table 4. Electrical characteristics of LM2931B 3.3V (refer to the test circuits, $T_J = 25^\circ\text{C}$, $C_I = 0.1 \mu\text{F}$, $C_O = 100 \mu\text{F}$, $V_I = 14\text{V}$, $I_O = 10\text{mA}$, $V_{INH} = 0\text{V}$, unless otherwise specified).

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_I	Maximum operating input voltage	$I_O = 10 \text{ mA}$, $T_J = -40 \text{ to } 125^\circ\text{C}$	26	37		V
V_O	Output voltage		3.135	3.3	3.465	V
V_O	Output voltage	$I_O = 100 \text{ mA}$, $V_I = 6 \text{ to } 26 \text{ V}$ $T_J = -40 \text{ to } 125^\circ\text{C}$	2.97	3.3	3.63	V
ΔV_O	Line regulation	$V_I = 9 \text{ to } 16 \text{ V}$		2	10	mV
		$V_I = 6 \text{ to } 26 \text{ V}$		4	33	
ΔV_O	Load regulation	$I_O = 5 \text{ to } 100 \text{ mA}$		10	33	mV
V_d	Dropout voltage ⁽¹⁾ ⁽²⁾	$I_O = 10 \text{ mA}$		90	200	mV
		$I_O = 100 \text{ mA}$		250	600	
I_d	Quiescent current ON MODE	$I_O = 100 \text{ mA}$		2.5	30	mA
	OFF MODE	$V_{INH} = 2.5 \text{ V}$, $R_{LOAD} = 330 \Omega$		0.3	1	mA
I_{SC}	Short circuit current		100	300		mA
SVR	Supply voltage rejection	$I_O = 100 \text{ mA}$, $V_I = 14 \pm 2 \text{ V}$ $f = 120 \text{ Hz}$, $T_J = -40 \text{ to } 125^\circ\text{C}$	55	78		dB
V_{IL}	Control input voltage low	$T_J = -40 \text{ to } 125^\circ\text{C}$		2	1.2	V
V_{IH}	Control input voltage high	$T_J = -40 \text{ to } 125^\circ\text{C}$	3.25	2		V
I_{INH}	Inhibit input current	$V_{INH} = 2.5 \text{ V}$		22	50	μA
V_I	Transient input voltage	$R_{LOAD} = 330 \Omega$, $\tau < 100\text{ms}$	60	70		V
V_I	Reverse polarity input voltage	$V_O = \pm 0.3 \text{ V}$, $R_{LOAD} = 330 \Omega$	-15	-50		V
V_I	Reverse polarity input voltage transient	$R_{LOAD} = 330 \Omega$, $\tau < 100\text{ms}$	-50			V
eN	Output noise voltage	$B = 10 \text{ Hz to } 100 \text{ KHz}$		330		μV_{RMS}

1. Reference Voltage is measured from V_{OUT} to ADJ pin.

2. V_d measured when the output voltage has dropped 100mV from the nominal value obtained at 14V.

Table 5. Electrical characteristics of LM2931A 5V (refer to the test circuits, $T_J = 25^\circ\text{C}$, $C_1 = 0.1 \mu\text{F}$, $C_O = 100 \mu\text{F}$, $V_I = 14\text{V}$, $I_O = 10\text{mA}$, $V_{INH} = 0\text{V}$, unless otherwise specified).

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_I	Maximum operating input voltage	$I_O = 10 \text{ mA}$, $T_J = -40 \text{ to } 125^\circ\text{C}$	26	37		V
V_O	Output voltage		4.81	5	5.19	V
V_O	Output voltage	$I_O = 100 \text{ mA}$, $V_I = 6 \text{ to } 26 \text{ V}$ $T_J = -40 \text{ to } 125^\circ\text{C}$	4.75	5	5.25	V
ΔV_O	Line regulation	$V_I = 9 \text{ to } 16 \text{ V}$		2	10	mV
		$V_I = 6 \text{ to } 26 \text{ V}$		4	30	
ΔV_O	Load regulation	$I_O = 5 \text{ to } 100 \text{ mA}$		15	50	mV
V_d	Dropout voltage ⁽¹⁾ ⁽²⁾	$I_O = 10 \text{ mA}$		90	200	mV
		$I_O = 100 \text{ mA}$		250	600	
I_d	Quiescent current ON MODE	$I_O = 100 \text{ mA}$		2.5	30	mA
	OFF MODE	$V_{INH} = 2.5 \text{ V}$, $R_{LOAD} = 500 \Omega$		0.3	1	mA
I_{SC}	Short circuit current		100	300		mA
SVR	Supply voltage rejection	$I_O = 100 \text{ mA}$, $V_I = 14 \pm 2 \text{ V}$ $f = 120 \text{ Hz}$, $T_J = -40 \text{ to } 125^\circ\text{C}$	55	75		dB
V_{IL}	Control input voltage low	$T_J = -40 \text{ to } 125^\circ\text{C}$		2	1.2	V
V_{IH}	Control input voltage high	$T_J = -40 \text{ to } 125^\circ\text{C}$	3.25	2		V
I_{INH}	Inhibit input current	$V_{INH} = 2.5 \text{ V}$		22	50	μA
V_I	Transient input voltage	$R_{LOAD} = 500 \Omega$, $\tau < 100\text{ms}$	60	70		V
V_I	Reverse polarity input voltage	$V_O = \pm 0.3 \text{ V}$, $R_{LOAD} = 500 \Omega$	-15	-50		V
V_I	Reverse polarity input voltage transient	$R_{LOAD} = 500 \Omega$, $\tau < 100\text{ms}$	-50			V
eN	Output noise voltage	$B = 10 \text{ Hz to } 100 \text{ KHz}$		500		μV_{RMS}

1. Reference Voltage is measured from V_{OUT} to ADJ pin.

2. V_d measured when the output voltage has dropped 100mV from the nominal value obtained at 14V.

Table 6. Electrical characteristics of LM2931B 5V (refer to the test circuits, $T_J = 25^\circ\text{C}$, $C_I = 0.1 \mu\text{F}$, $C_O = 100 \mu\text{F}$, $V_I = 14\text{V}$, $I_O = 10\text{mA}$, $V_{INH} = 0\text{V}$, unless otherwise specified).

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_I	Maximum operating input voltage	$I_O = 10 \text{ mA}$, $T_J = -40 \text{ to } 125^\circ\text{C}$	26	37		V
V_O	Output voltage		4.75	5	5.25	V
V_O	Output voltage	$I_O = 100 \text{ mA}$, $V_I = 6 \text{ to } 26 \text{ V}$ $T_J = -40 \text{ to } 125^\circ\text{C}$	4.5	5	5.5	V
ΔV_O	Line regulation	$V_I = 9 \text{ to } 16 \text{ V}$		2	10	mV
		$V_I = 6 \text{ to } 26 \text{ V}$		4	30	
ΔV_O	Load regulation	$I_O = 5 \text{ to } 100 \text{ mA}$		15	50	mV
V_d	Dropout voltage ⁽¹⁾ ⁽²⁾	$I_O = 10 \text{ mA}$		90	200	mV
		$I_O = 100 \text{ mA}$		250	600	
I_d	Quiescent current ON MODE	$I_O = 100 \text{ mA}$		2.5	30	mA
	OFF MODE	$V_{INH} = 2.5 \text{ V}$, $R_{LOAD} = 500 \Omega$		0.3	1	mA
I_{SC}	Short circuit current		100	300		mA
SVR	Supply voltage rejection	$I_O = 100 \text{ mA}$, $V_I = 14 \pm 2 \text{ V}$ $f = 120 \text{ Hz}$, $T_J = -40 \text{ to } 125^\circ\text{C}$	55	75		dB
V_{IL}	Control input voltage low	$T_J = -40 \text{ to } 125^\circ\text{C}$		2	1.2	V
V_{IH}	Control input voltage high	$T_J = -40 \text{ to } 125^\circ\text{C}$	3.25	2		V
I_{INH}	Inhibit input current	$V_{INH} = 2.5 \text{ V}$		22	50	μA
V_I	Transient input voltage	$R_{LOAD} = 500 \Omega$, $\tau < 100\text{ms}$	60	70		V
V_I	Reverse polarity input voltage	$V_O = \pm 0.3 \text{ V}$, $R_{LOAD} = 500 \Omega$	-15	-50		V
V_I	Reverse polarity input voltage transient	$R_{LOAD} = 500 \Omega$, $\tau < 100\text{ms}$	-50			V
eN	Output noise voltage	$B = 10 \text{ Hz to } 100 \text{ KHz}$		500		μV_{RMS}

1. Reference Voltage is measured from V_{OUT} to ADJ pin.

2. V_d measured when the output voltage has dropped 100mV from the nominal value obtained at 14V.

Table 7. Electrical characteristics of LM2931ADJ (refer to the test circuits figure 2 with $R_1 = 27k\Omega$ and $R_2 = 40.5k\Omega$, $T_J = 25^\circ\text{C}$, $C_1 = 0.1 \mu\text{F}$, $C_O = 100 \mu\text{F}$, $V_I = 14\text{V}$, $I_O = 10\text{mA}$, $V_{INH} = 0\text{V}$, unless otherwise specified).

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_I	Maximum Operating Input Voltage	$I_O = 10 \text{ mA}$, $T_J = -40 \text{ to } 125^\circ\text{C}$	26	37		V
V_{REF}	Reference Voltage ⁽¹⁾		1.14	1.2	1.26	V
V_{REF}	Reference Voltage ⁽¹⁾	$I_O = 100 \text{ mA}$, $T_J = -40 \text{ to } 125^\circ\text{C}$	1.08	1.2	1.32	V
ΔV_O	Line Regulation	$V_I = 3.6 \text{ to } 26 \text{ V}$		0.6	4.5	mV
ΔV_O	Load Regulation	$I_O = 5 \text{ to } 100 \text{ mA}$		9	30	mV
V_d	Dropout Voltage ^{(1) (2)}	$I_O = 10 \text{ mA}$		90	200	mV
		$I_O = 100 \text{ mA}$		250	600	
I_d	Quiescent Current ON MODE	$I_O = 100 \text{ mA}$		2.5	30	mA
	OFF MODE	$V_{INH} = 2.5 \text{ V}$, $R_{LOAD} = 300 \Omega$		0.3	1	mA
I_{SC}	Short Circuit Current		100	300		mA
SVR	Supply Voltage Rejection	$I_O = 100 \text{ mA}$, $V_I = 14 \pm 2 \text{ V}$ $f = 120 \text{ Hz}$, $T_J = -40 \text{ to } 125^\circ\text{C}$	55	80		dB
V_{IL}	Control Input Voltage Low	$T_J = -40 \text{ to } 125^\circ\text{C}$		2	1.2	V
V_{IH}	Control Input Voltage High	$T_J = -40 \text{ to } 125^\circ\text{C}$	3.25	2		V
I_{INH}	Inhibit Input Current	$V_{INH} = 2.5 \text{ V}$		22	50	μA
V_I	Transient Input Voltage	$R_{LOAD} = 300 \Omega$, $\tau < 100\text{ms}$	60	70		V
V_I	Reverse Polarity Input Voltage	$V_O = \pm 0.3 \text{ V}$, $R_{LOAD} = 300 \Omega$	-15	-50		V
V_I	Reverse Polarity Input Voltage Transient	$R_{LOAD} = 300 \Omega$, $\tau < 100\text{ms}$	-50			V
eN	Output Noise Voltage	B = 10 Hz to 100 KHz		330		μV_{RMS}

1. Reference Voltage is measured from V_{OUT} to ADJ pin.

2. V_d measured when the output voltage has dropped 100mV from the nominal value obtained at 14V.

6 Typical characteristics

(unless otherwise specified $C_1 = 0.1 \mu\text{F}$, $C_O = 100 \mu\text{F}$).

Figure 5. Output voltage vs temperature

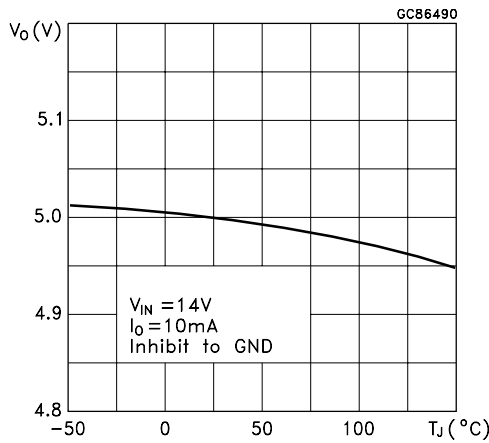


Figure 6. Output voltage vs temperature

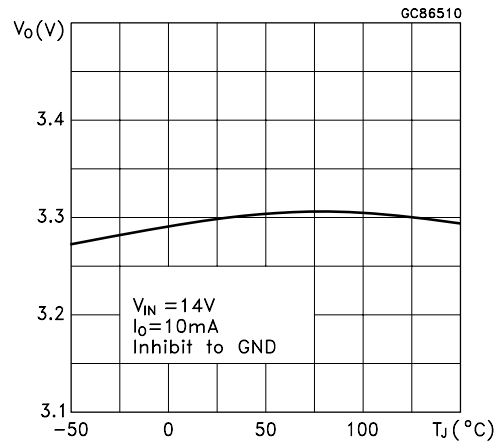


Figure 7. Reference voltage vs temperature

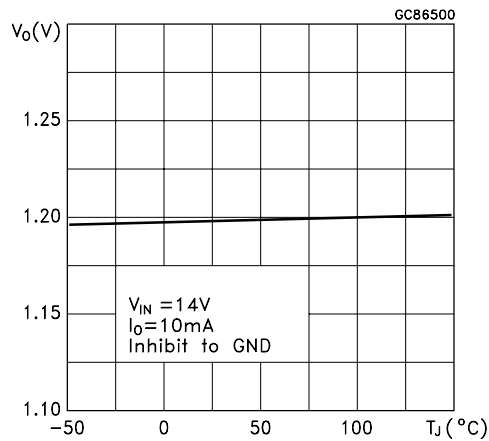


Figure 8. Line regulation vs temperature

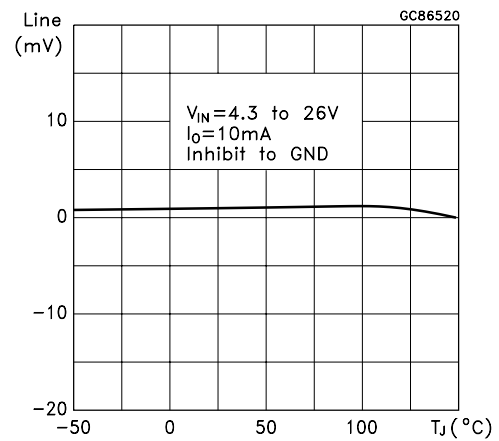


Figure 9. Load regulation vs temperature

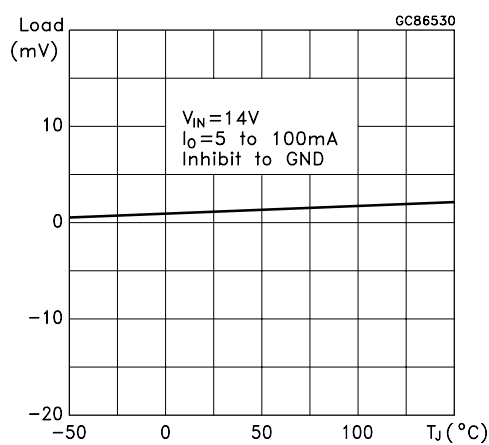


Figure 10. Dropout voltage vs temperature

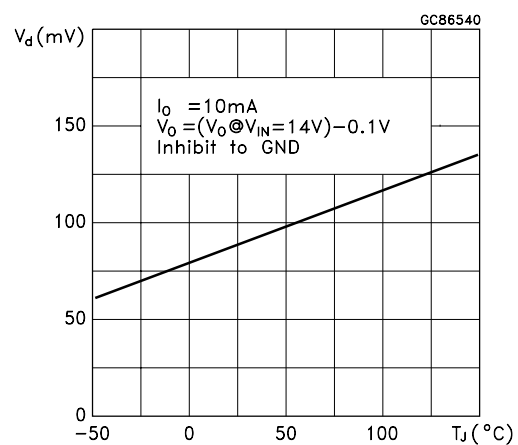


Figure 11. Dropout voltage vs temperature

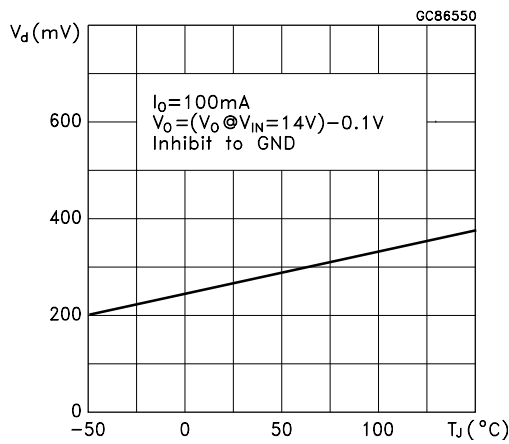


Figure 12. Dropout voltage vs output current

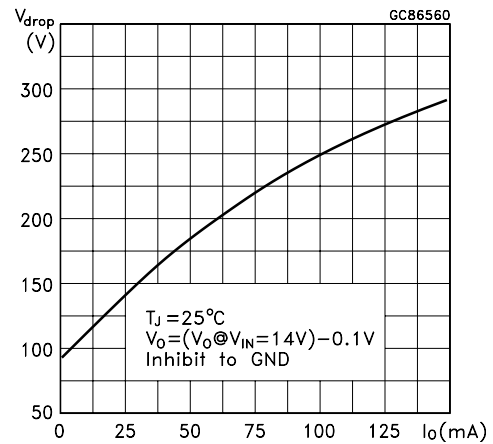


Figure 13. Output voltage vs input voltage

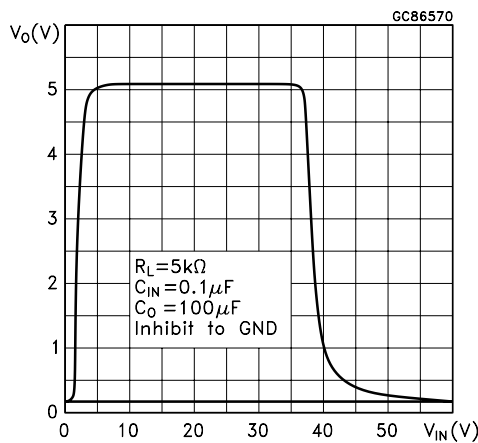


Figure 14. Short circuit current vs drop voltage

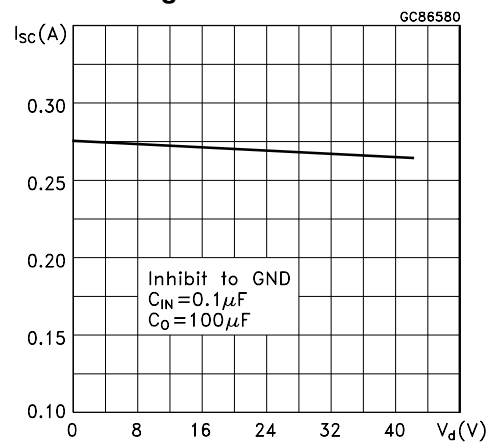


Figure 15. Quiescent current vs temperature

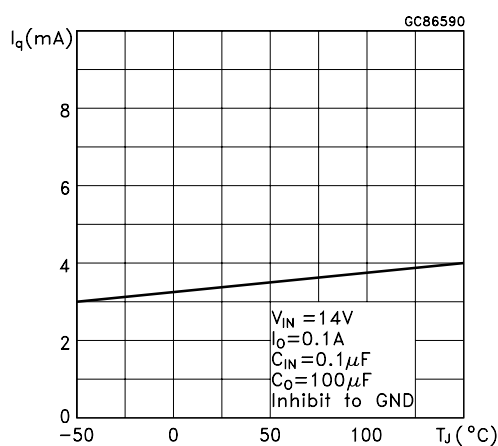


Figure 16. Quiescent current vs input voltage

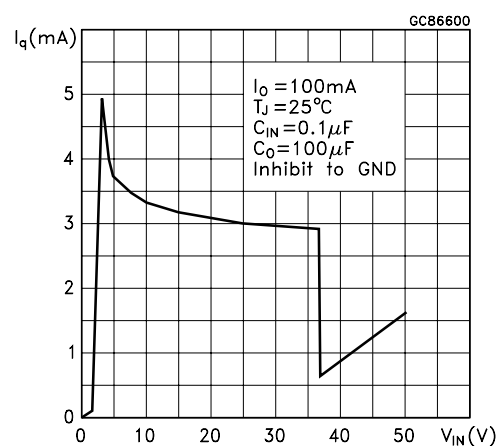


Figure 17. Quiescent current vs output current

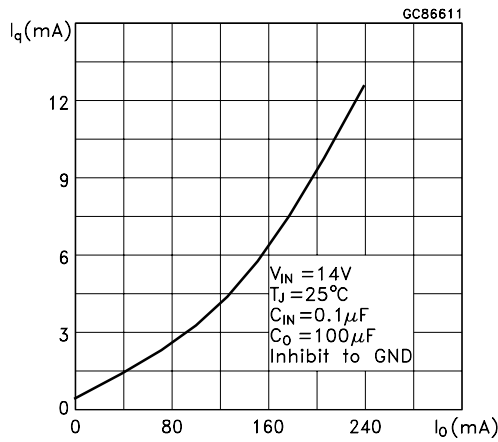


Figure 18. Supply voltage rejection vs temperature

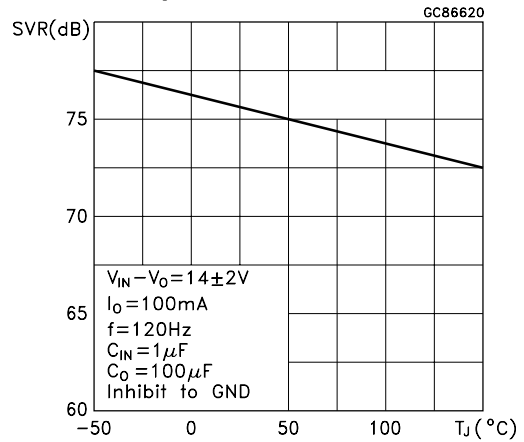


Figure 19. Supply voltage rejection vs frequency

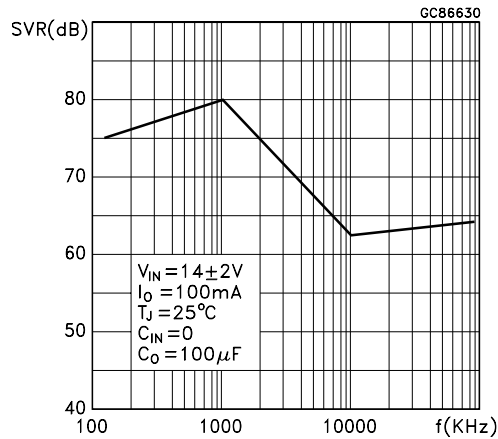


Figure 20. Supply voltage rejection vs output current

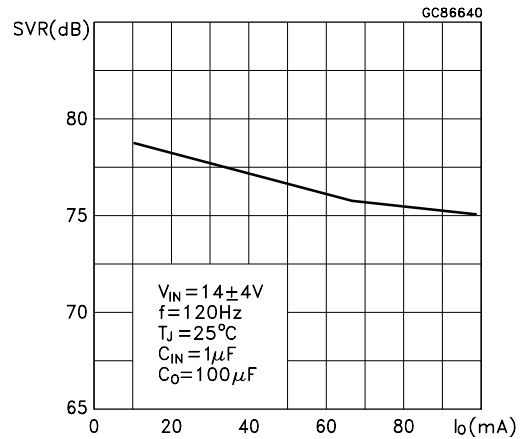


Figure 21. Stability vs CO

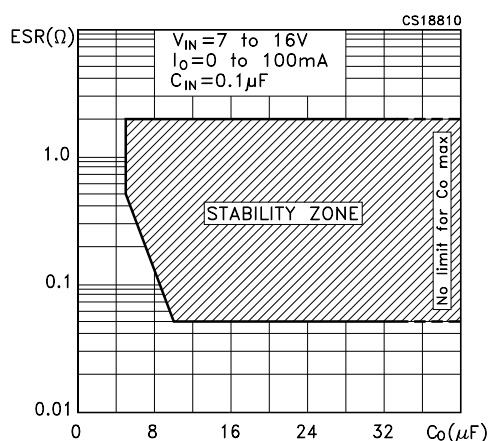
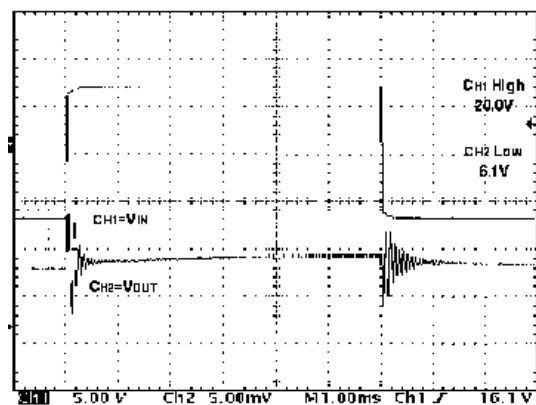
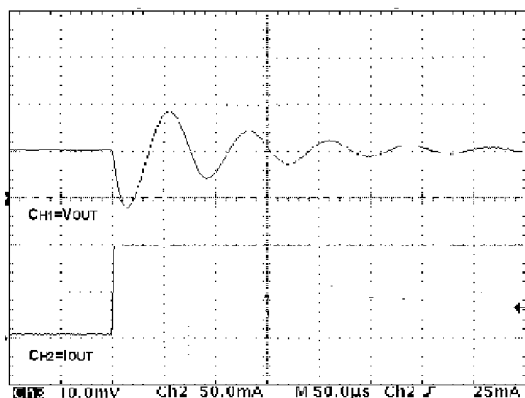


Figure 22. Line transient



$V_I = 6$ to $20V$, $R_L = 500\Omega$, $T_J = 25^\circ C$, $C_I = 0$, $C_O = 100\mu F$, Rise/Fall-Time = 200 ns

Figure 23. Line transient



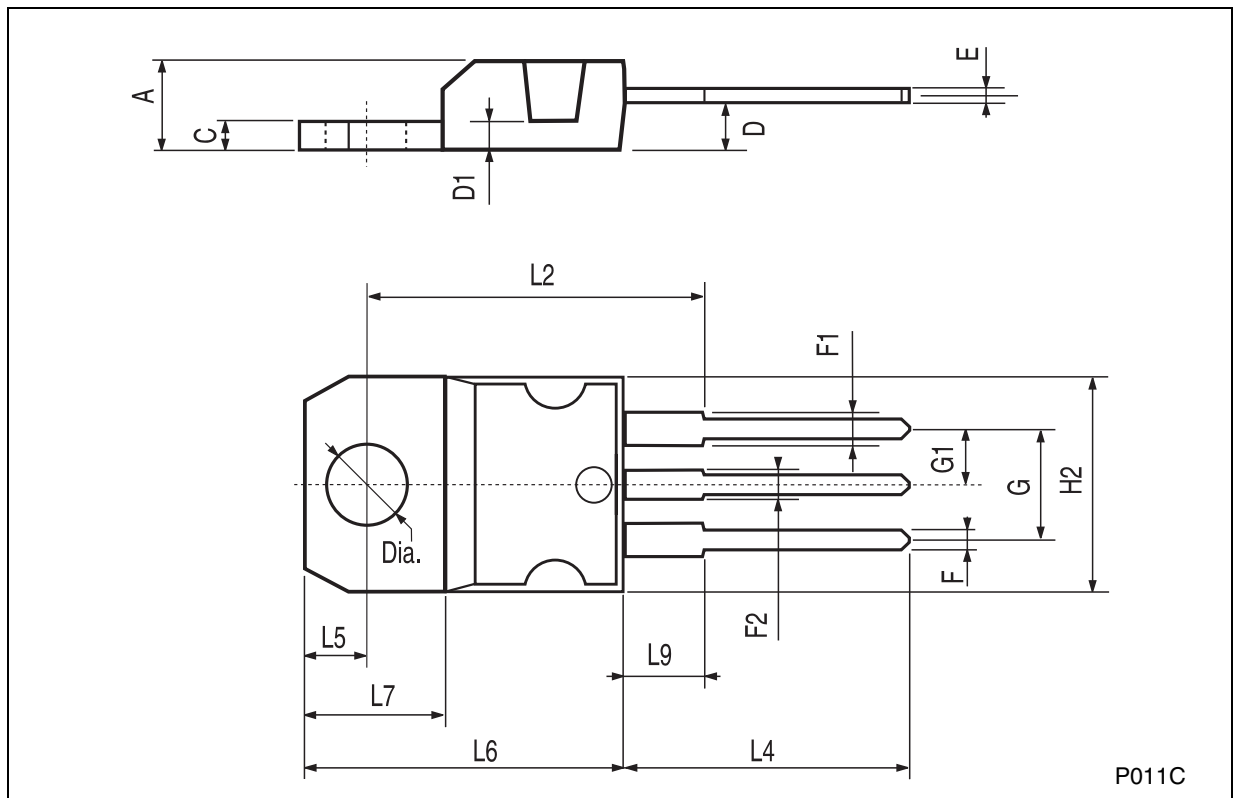
$V_I = 14\text{ V}$, $I_O = 100\text{mA}$, $T_J = 25^\circ\text{C}$, $C_I = 0.1\mu\text{F}$, $C_O = 100\mu\text{F}$,
Rise Time = 500ns, Fall-Time = 1 μs

7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

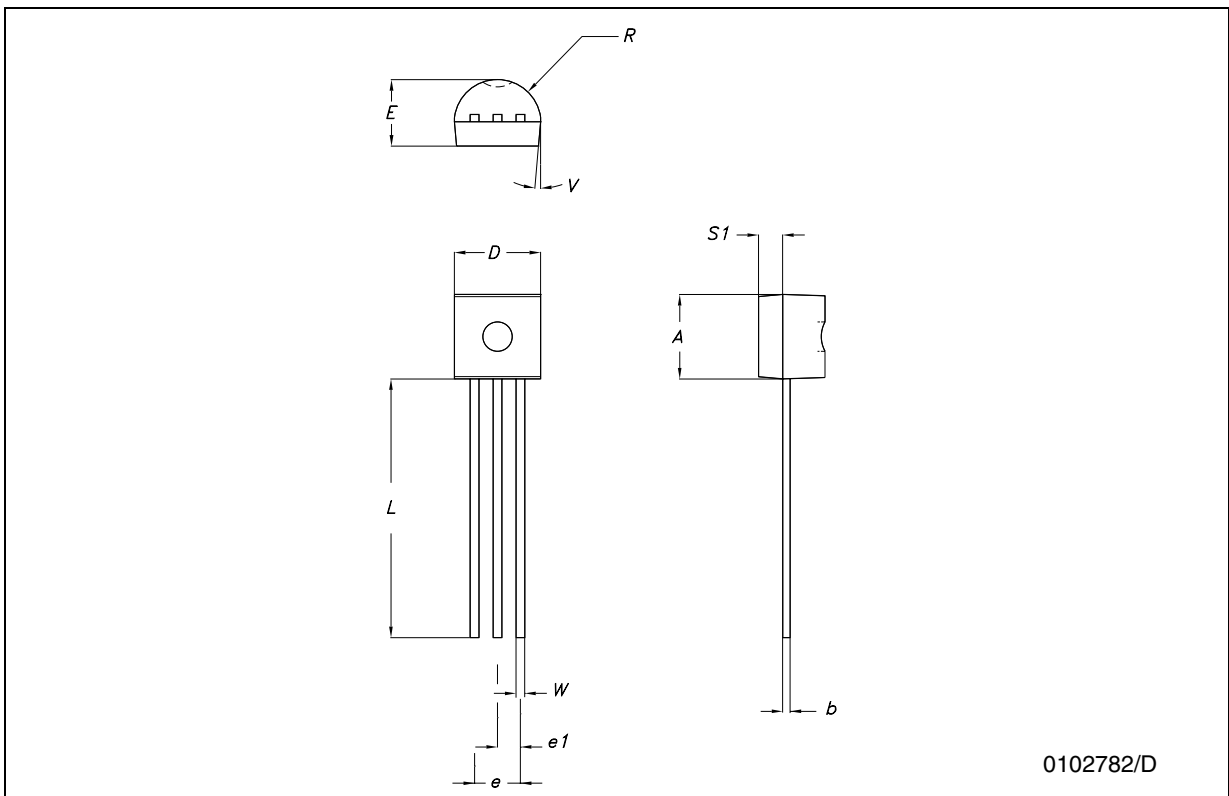
TO-220 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



TO-92 MECHANICAL DATA

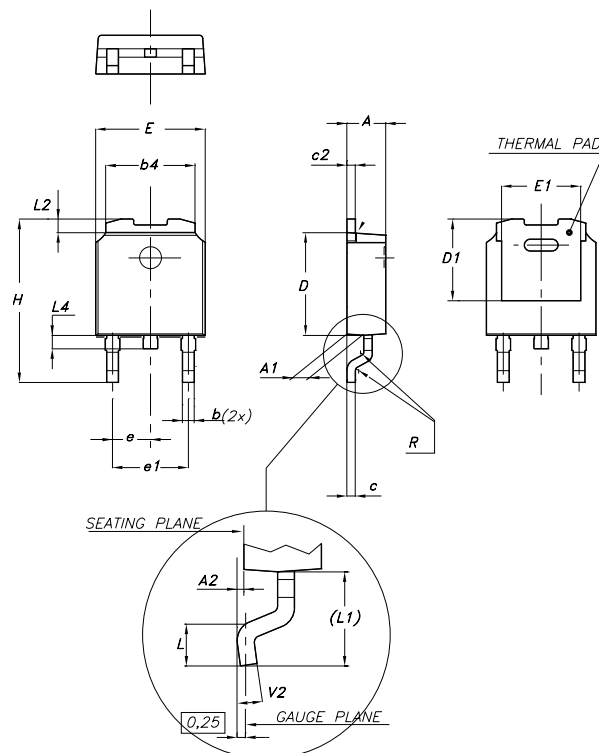
DIM.	mm.			mils		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.32		4.95	170.1		194.9
b	0.36		0.51	14.2		20.1
D	4.45		4.95	175.2		194.9
E	3.30		3.94	129.9		155.1
e	2.41		2.67	94.9		105.1
e1	1.14		1.40	44.9		55.1
L	12.7		15.49	500.0		609.8
R	2.16		2.41	85.0		94.9
S1	0.92		1.52	36.2		59.8
W	0.41		0.56	16.1		22.0
α		5°			5°	



0102782/D

DPAK MECHANICAL DATA

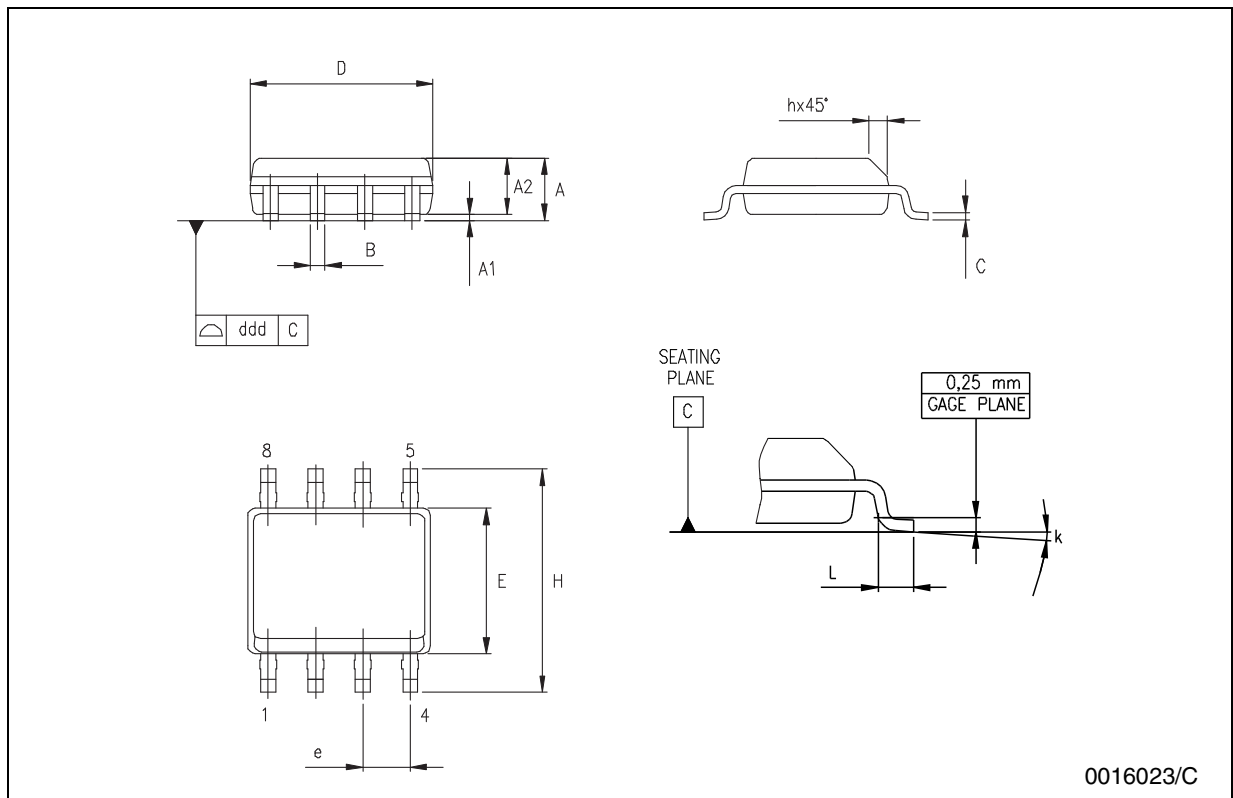
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
D1		5.1			0.200	
E	6.4		6.6	0.252		0.260
E1		4.7			0.185	
e		2.28			0.090	
e1	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L	1			0.039		
(L1)		2.8			0.110	
L2		0.8			0.031	
L4	0.6		1	0.023		0.039
R		0.2			0.008	
V2	0°		8°	0°		8°



0068772-F

SO-8 MECHANICAL DATA

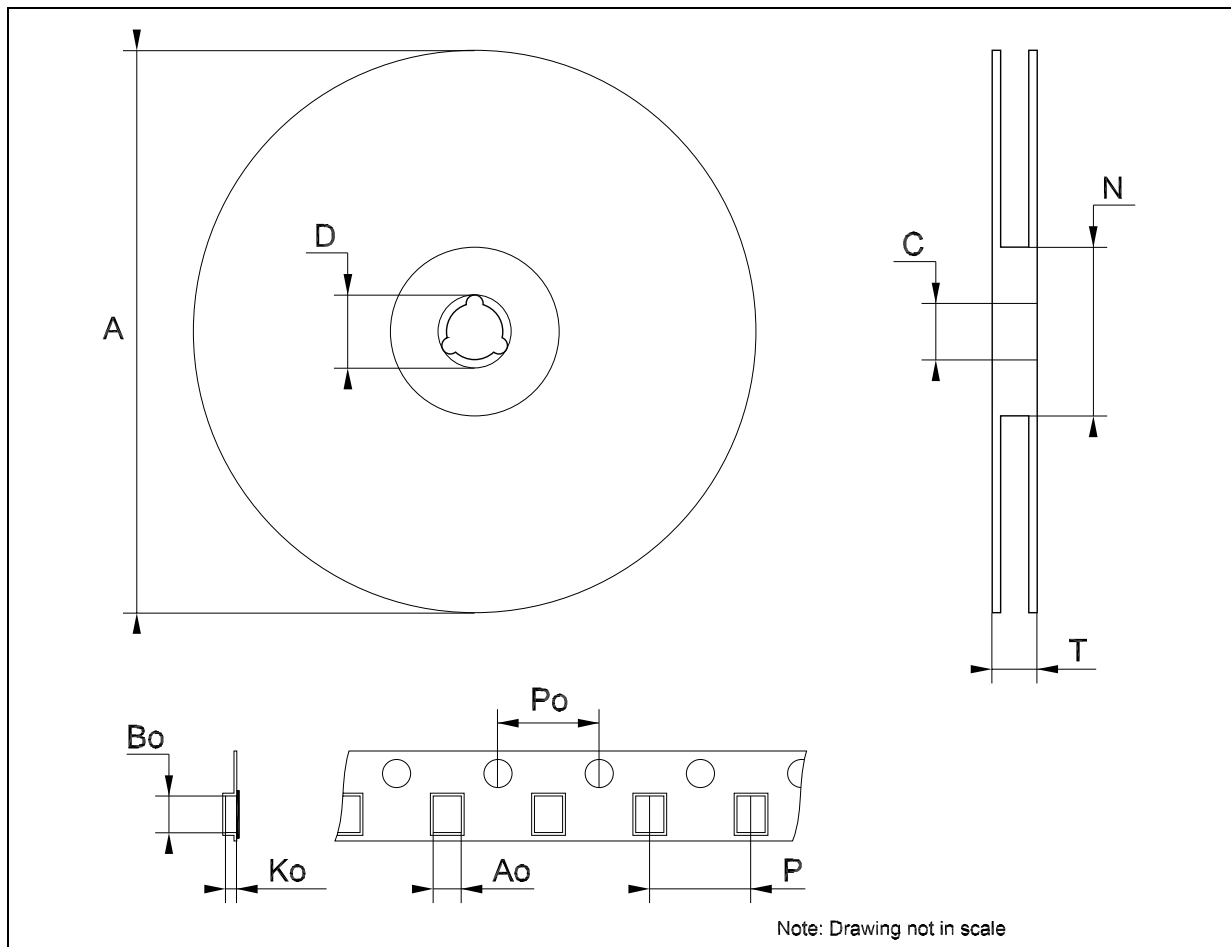
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	8° (max.)					
ddd			0.1			0.04



0016023/C

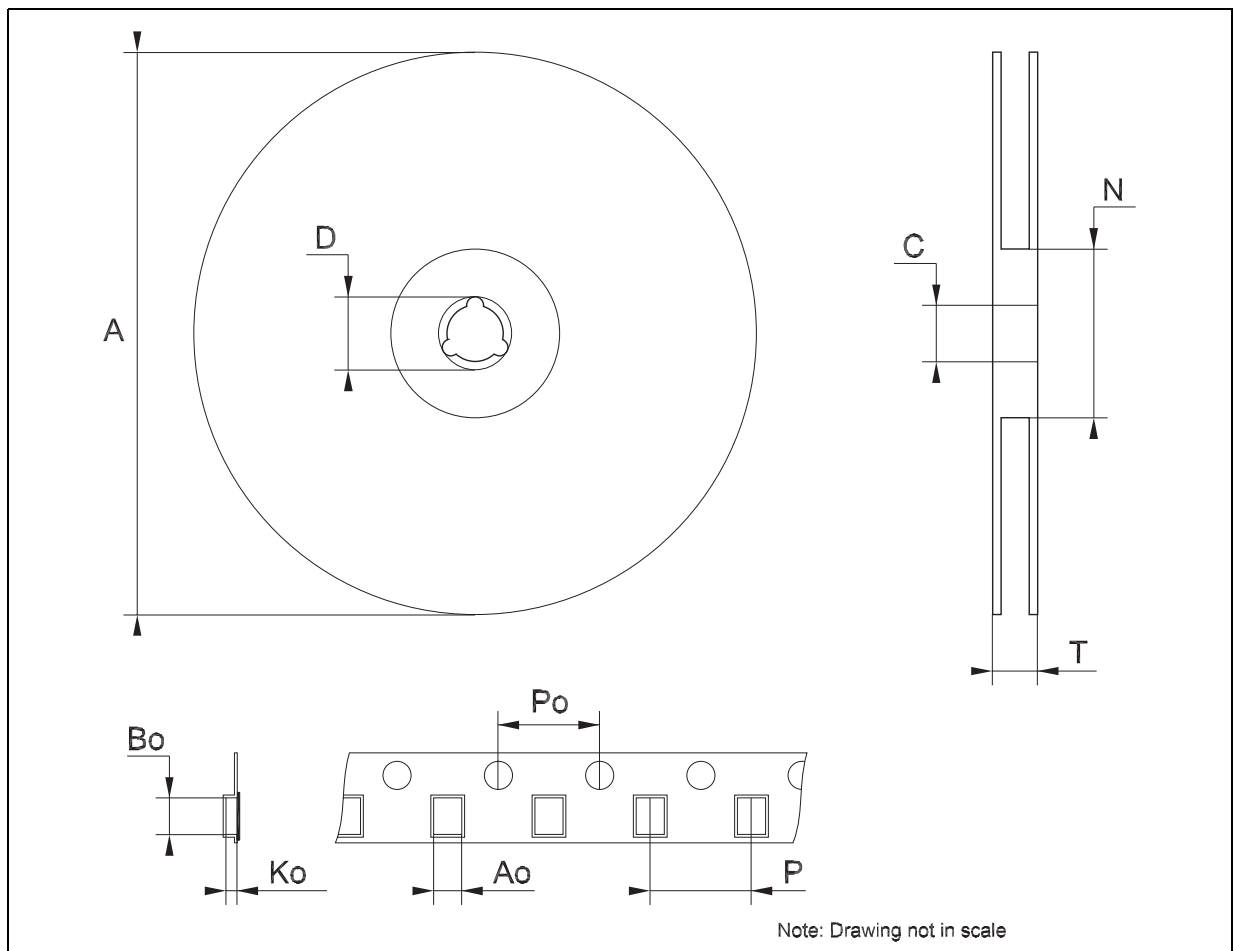
Tape & Reel DPAK-PPAK MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.80	6.90	7.00	0.268	0.272	0.276
Bo	10.40	10.50	10.60	0.409	0.413	0.417
Ko	2.55	2.65	2.75	0.100	0.104	0.105
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	7.9	8.0	8.1	0.311	0.315	0.319



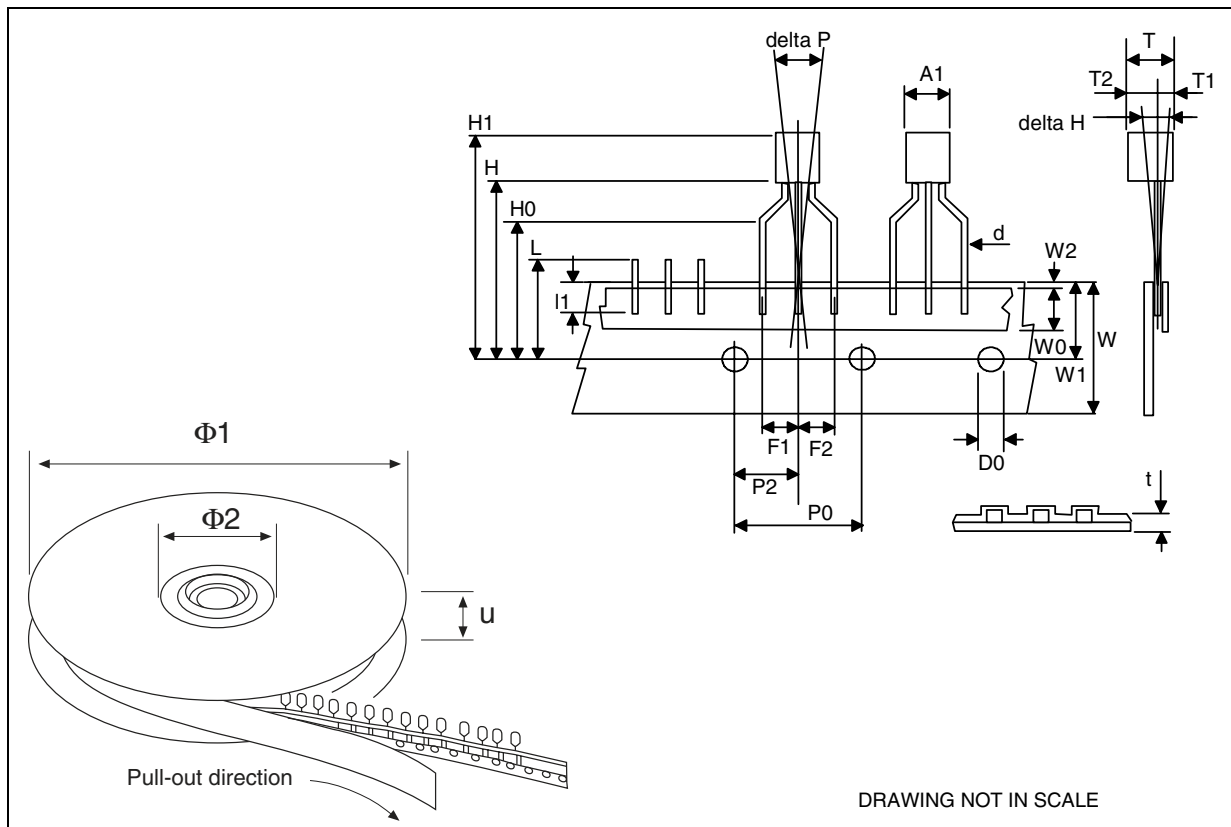
Tape & Reel SO-8 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	8.1		8.5	0.319		0.335
Bo	5.5		5.9	0.216		0.232
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



Tape & Reel for TO-92 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A1		4.80			0.189	
T		3.80			0.150	
T1		1.60			0.063	
T2		2.30			0.091	
d		0.48			0.019	
P0	12.5		12.9	0.492		0.508
P2	5.65		7.05	0.222		0.278
F1, F2	2.44	2.54	2.94	0.096	0.100	0.116
delta H		±2			0.079	
W	17.5	18.00	19.0	0.689	0.709	0.748
W0	5.7		6.3	0.224		0.248
W1	8.5		9.25	0.335		0.364
W2		0.50			0.20	
H		18.50	18.70		0.728	0.726
H0	15.50		16.50	0.610		0.650
H1		25.00			0.984	
D0	3.8		4.2	0.150		0.165
t		0.90			0.035	
L1		3			0.118	
delta P		±1			0.039	
u		50			1.968	
Φ1		360			14.173	
Φ2		30			1.181	



8 Revision history

Table 8. Revision history

Date	Revision	Changes
21-Jun-2004	12	Document updating.
16-Jun-2006	13	Order Codes has been updated and new template.

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