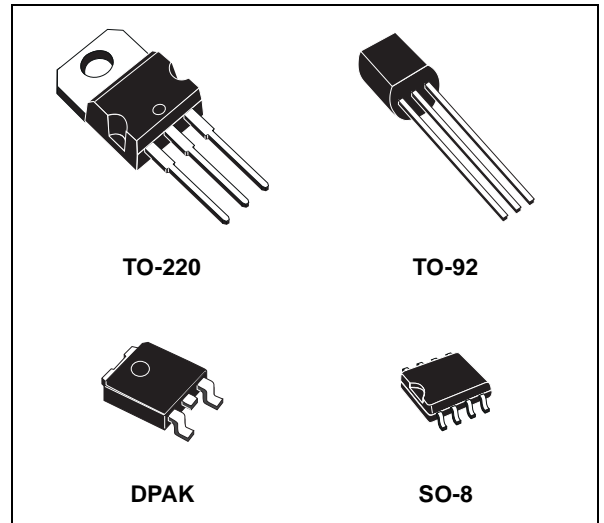


## VERY LOW DROP VOLTAGE REGULATORS WITH INHIBIT FUNCTION

- 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)



### 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.

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.

**Figure 1: Schematic Diagram**

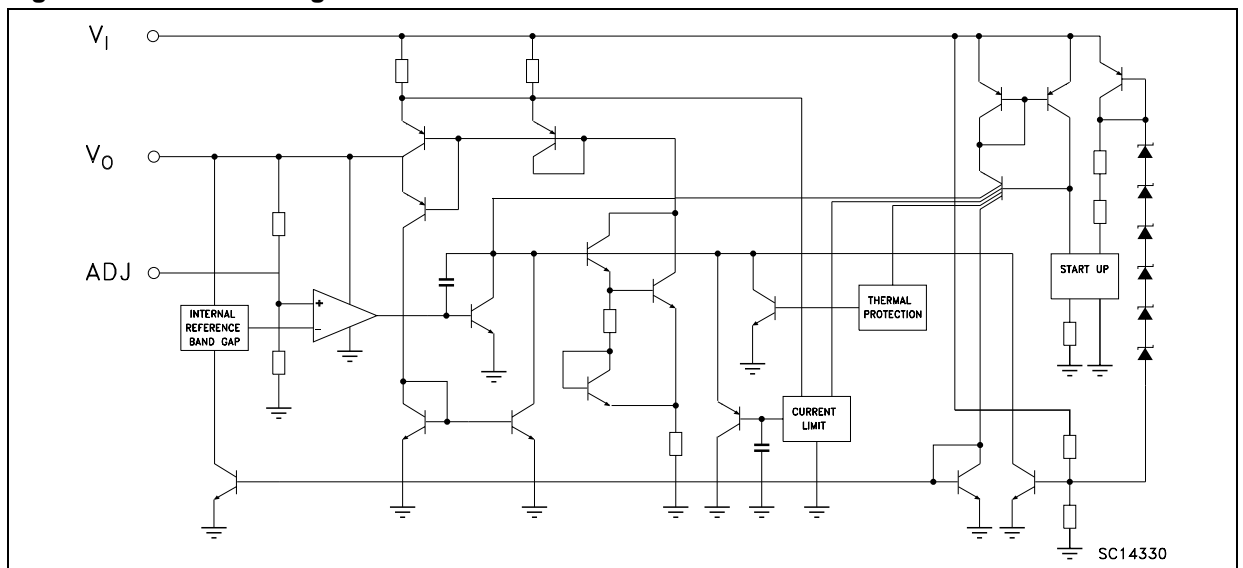


Table 1: Absolute Maximum Ratings

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

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
$R_{thj-case}$	Thermal Resistance Junction-case	3	20	8		°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	50	55(*)	100	200	°C/W

(\*) Considering 6 cm<sup>2</sup> of copper board heat-sink

Figure 2: Pin Connection (top view)

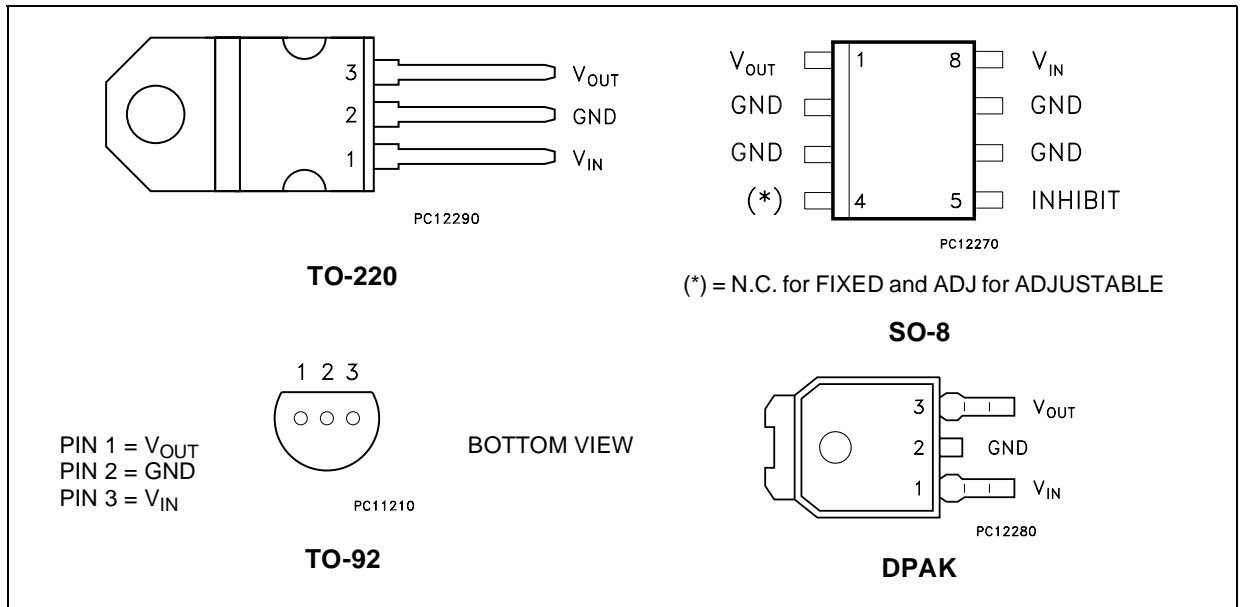


Table 3: Ordering Codes

TO-220	DPAK (*)	TO-92 (BAG) (#)	SO-8 (*)	OUTPUT VOLTAGE
LM2931AV33	LM2931ADT33	LM2931AZ33	LM2931AD33	3.3 V
LM2931BV33	LM2931BDT33	LM2931BZ33	LM2931BD33	3.3 V
LM2931AV50	LM2931ADT50	LM2931AZ50	LM2931AD50	5.0 V
LM2931BV50	LM2931BDT50	LM2931BZ50	LM2931BD50	5.0 V
			LM2931D	2.5 to 26 V

(\*) Available in Tape & Reel with the suffix "R" for fixed version and "-R" for adjustable version.

(#) Available in Ammopak with the suffix "AP" or in Tape & Reel with the suffix "R". Please note that in these cases pins are shaped according to Tape & Reel specifications.

Figure 3: Application Circuit For Fixed Output

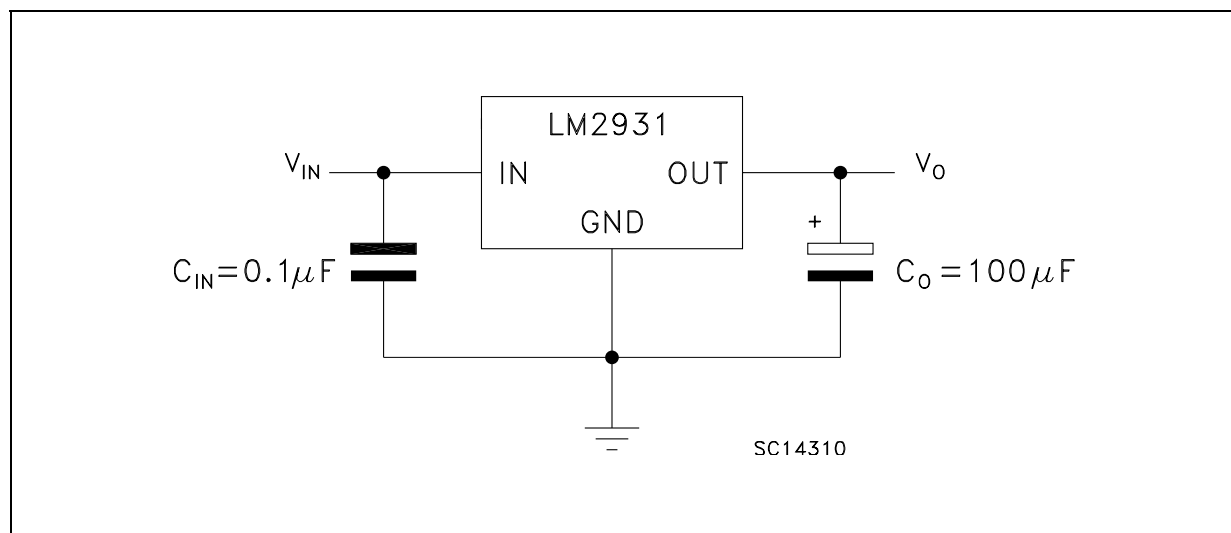
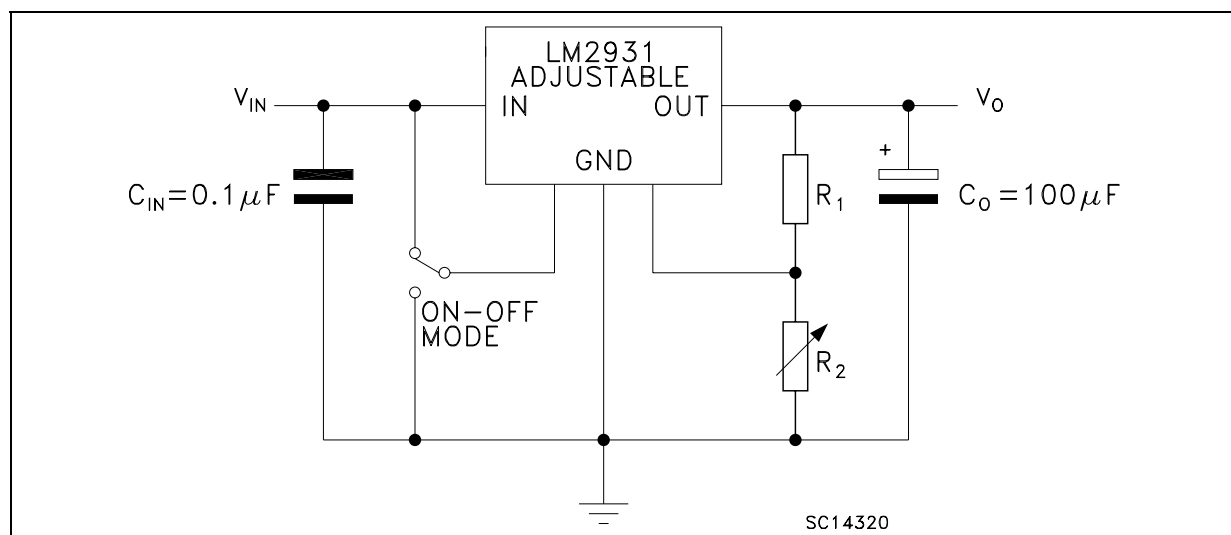


Figure 4: Application Circuit For Adjustable Output



$R_1$  suggested Value = 27K $\Omega$

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

**Table 4: 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
$\Delta V_O$	Line Regulation	$V_I = 9 \text{ to } 16 \text{ V}$		2	10	mV
		$V_I = 6 \text{ to } 26 \text{ V}$		4	33	
$\Delta V_O$	Load Regulation	$I_O = 5 \text{ to } 100 \text{ mA}$		10	33	mV
$V_d$	Dropout Voltage (Note 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	$\mu\text{A}$
$V_I$	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		$\mu\text{V}_{RMS}$

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

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

**Table 5: 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
$\Delta V_O$	Line Regulation	$V_I = 9 \text{ to } 16 \text{ V}$		2	10	mV
		$V_I = 6 \text{ to } 26 \text{ V}$		4	33	
$\Delta V_O$	Load Regulation	$I_O = 5 \text{ to } 100 \text{ mA}$		10	33	mV
$V_d$	Dropout Voltage (Note 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	$\mu\text{A}$
$V_I$	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		$\mu\text{V}_{RMS}$

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

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

**Table 6: Electrical Characteristics Of LM2931A 5V** (refer to the test circuits,  $T_J = 25^\circ\text{C}$ ,  $C_I = 0.1 \mu\text{F}$ ,  $C_O = 100 \mu\text{F}$ ,  $V_I = 14\text{V}$ ,  $I_O = 10\text{mA}$ ,  $V_{\text{INH}} = 0\text{V}$ , 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
$\Delta V_O$	Line Regulation	$V_I = 9 \text{ to } 16 \text{ V}$		2	10	mV
		$V_I = 6 \text{ to } 26 \text{ V}$		4	30	
$\Delta V_O$	Load Regulation	$I_O = 5 \text{ to } 100 \text{ mA}$		15	50	mV
$V_d$	Dropout Voltage (Note 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	$V_{\text{INH}} = 2.5 \text{ V}$ $R_{\text{LOAD}} = 500 \Omega$		0.3	1	mA
$I_{\text{SC}}$	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
$V_{\text{IL}}$	Control Input Voltage Low	$T_J = -40 \text{ to } 125^\circ\text{C}$		2	1.2	V
$V_{\text{IH}}$	Control Input Voltage High	$T_J = -40 \text{ to } 125^\circ\text{C}$	3.25	2		V
$I_{\text{INH}}$	Inhibit Input Current	$V_{\text{INH}} = 2.5 \text{ V}$		22	50	$\mu\text{A}$
$V_I$	Transient Input Voltage	$R_{\text{LOAD}} = 500 \Omega$ $\tau < 100\text{ms}$	60	70		V
$V_I$	Reverse Polarity Input Voltage	$V_O = \pm 0.3 \text{ V}$ $R_{\text{LOAD}} = 500 \Omega$	-15	-50		V
$V_I$	Reverse Polarity Input Voltage Transient	$R_{\text{LOAD}} = 500 \Omega$ $\tau < 100\text{ms}$	-50			V
eN	Output Noise Voltage	$B = 10 \text{ Hz to } 100 \text{ KHz}$		500		$\mu\text{V}_{\text{RMS}}$

Note 1: Reference Voltage is measured from  $V_{\text{OUT}}$  to ADJ pin.

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

**Table 7: 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
$\Delta V_O$	Line Regulation	$V_I = 9 \text{ to } 16 \text{ V}$		2	10	mV
		$V_I = 6 \text{ to } 26 \text{ V}$		4	30	
$\Delta V_O$	Load Regulation	$I_O = 5 \text{ to } 100 \text{ mA}$		15	50	mV
$V_d$	Dropout Voltage (Note 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	$\mu\text{A}$
$V_I$	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		$\mu\text{V}_{RMS}$

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

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

**Table 8: 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 (Note 1)		1.14	1.2	1.26	V
$V_{REF}$	Reference Voltage (Note 1)	$I_O = 100 \text{ mA}$ $T_J = -40 \text{ to } 125^\circ\text{C}$	1.08	1.2	1.32	V
$\Delta V_O$	Line Regulation	$V_I = 3.6 \text{ to } 26 \text{ V}$		0.6	4.5	mV
$\Delta V_O$	Load Regulation	$I_O = 5 \text{ to } 100 \text{ mA}$		9	30	mV
$V_d$	Dropout Voltage (Note 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	$\mu\text{A}$
$V_I$	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	$B = 10 \text{ Hz to } 100 \text{ KHz}$		330		$\mu\text{V}_{RMS}$

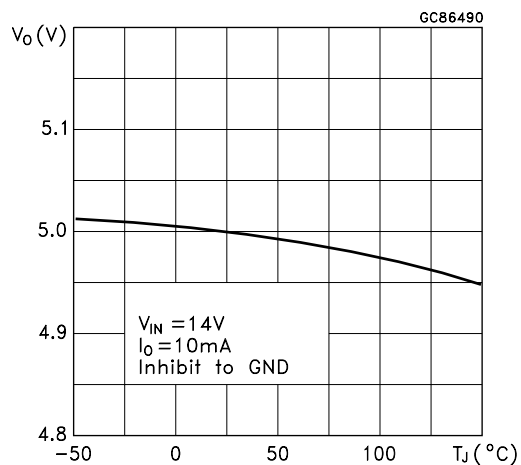
Note 1: Reference Voltage is measured from  $V_{OUT}$  to ADJ pin.

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

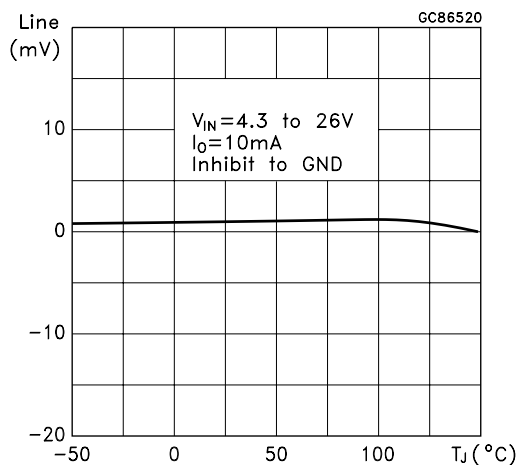


**TYPICAL CHARACTERISTICS** (unless otherwise specified  $C_1 = 0.1 \mu\text{F}$ ,  $C_0 = 100 \mu\text{F}$ ).

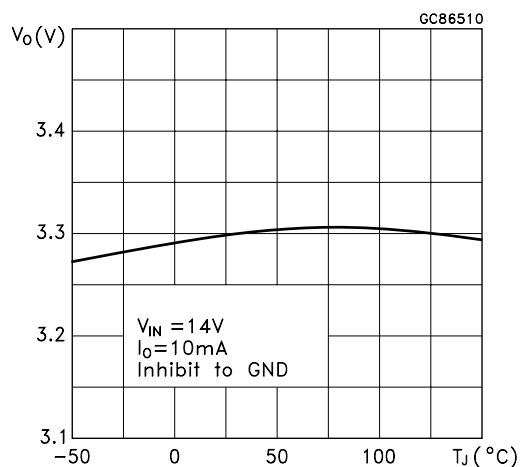
**Figure 5: Output Voltage vs Temperature**



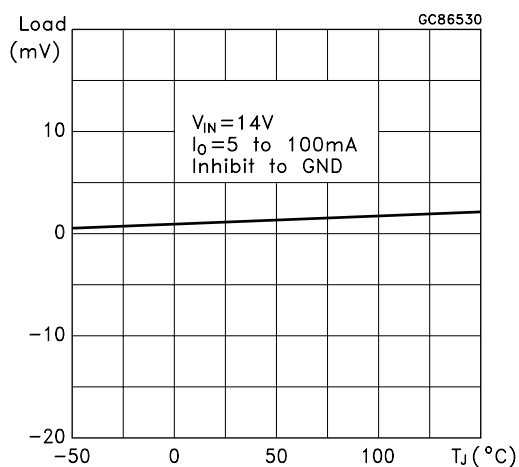
**Figure 8: Line Regulation vs Temperature**



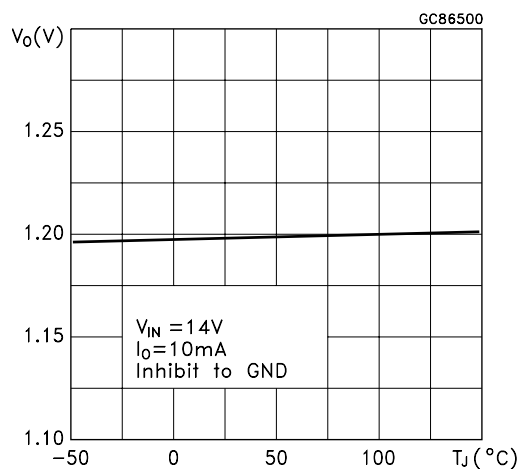
**Figure 6: Output Voltage vs Temperature**



**Figure 9: Load Regulation vs Temperature**



**Figure 7: Reference Voltage vs Temperature**



**Figure 10: Dropout Voltage vs Temperature**

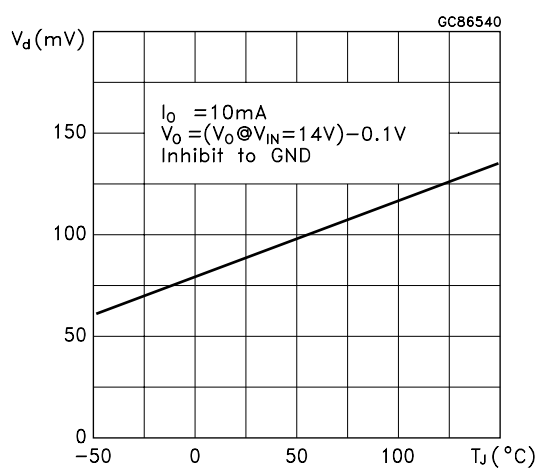


Figure 11: Dropout Voltage vs Temperature

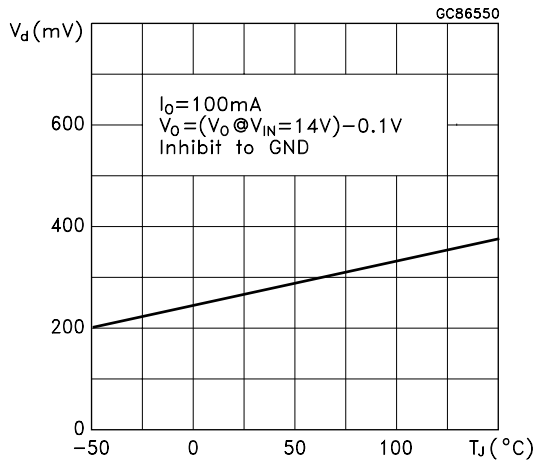


Figure 12: Dropout Voltage vs Output Current

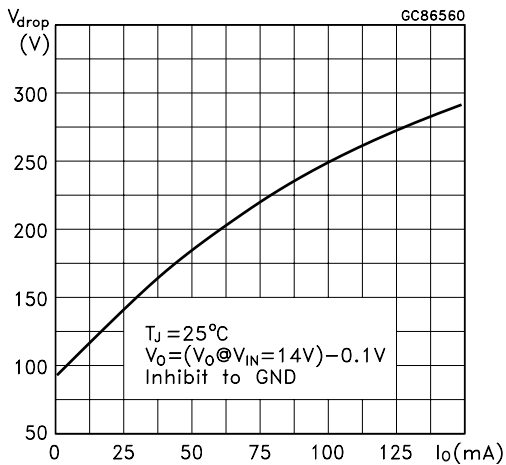


Figure 13: Output Voltage vs Input Voltage

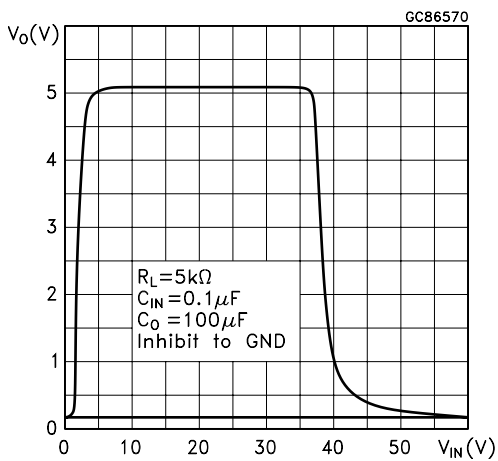


Figure 14: Short Circuit Current vs Drop Voltage

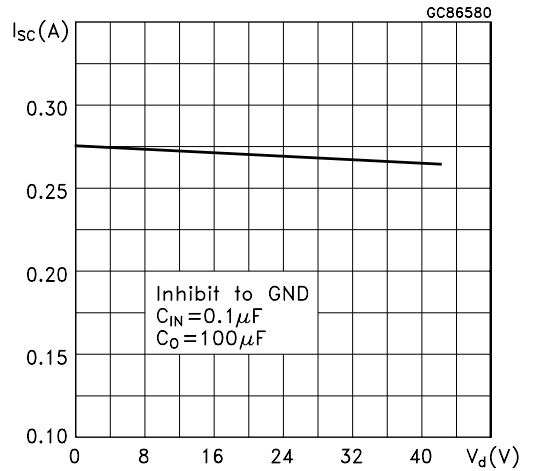


Figure 15: Quiescent Current vs Temperature

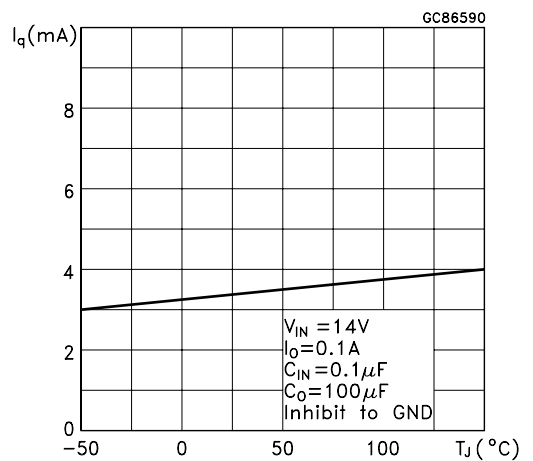


Figure 16: Quiescent Current vs Input Voltage

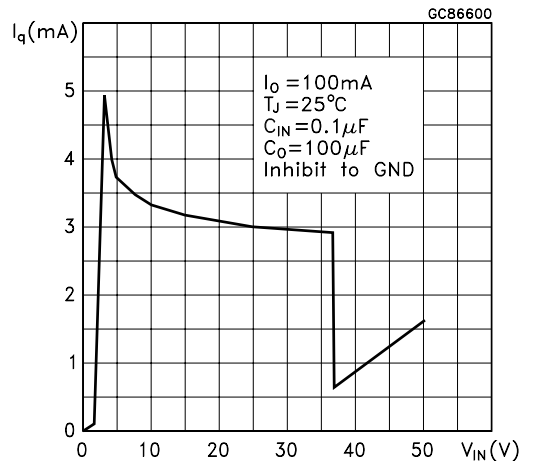


Figure 17: Quiescent Current vs Output Current

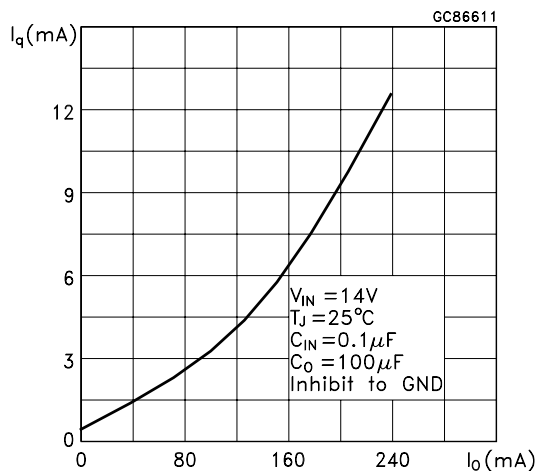


Figure 20: Supply Voltage Rejection vs Output Current

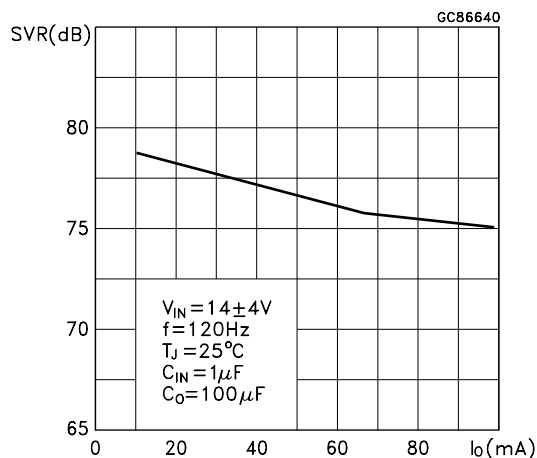


Figure 18: Supply Voltage Rejection vs Temperature

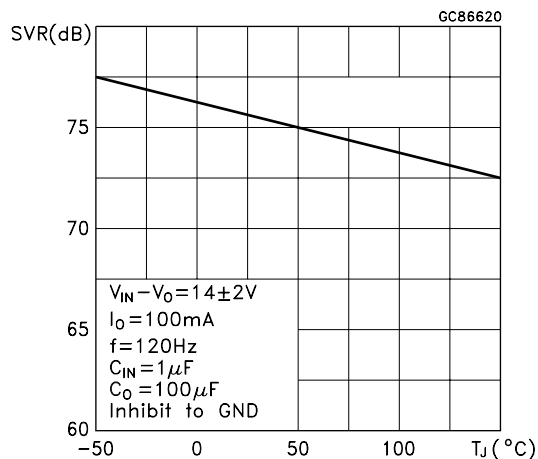


Figure 21: Stability vs CO

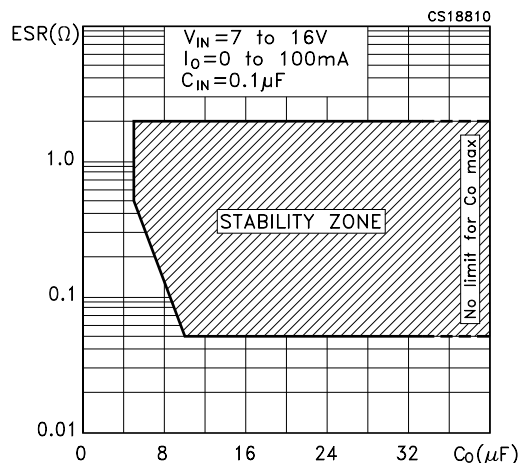


Figure 19: Supply Voltage Rejection vs Frequency

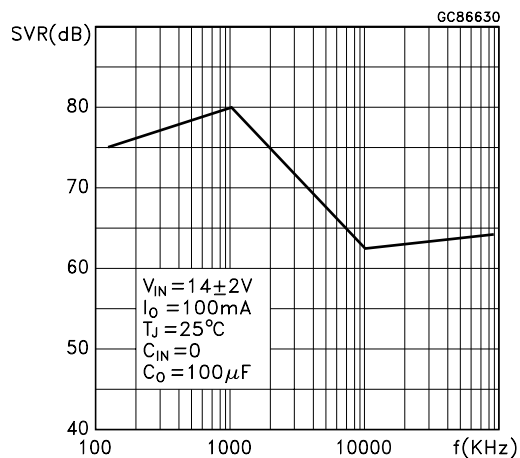
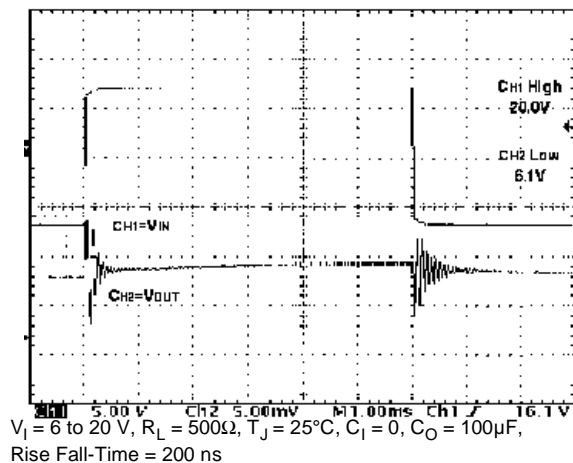
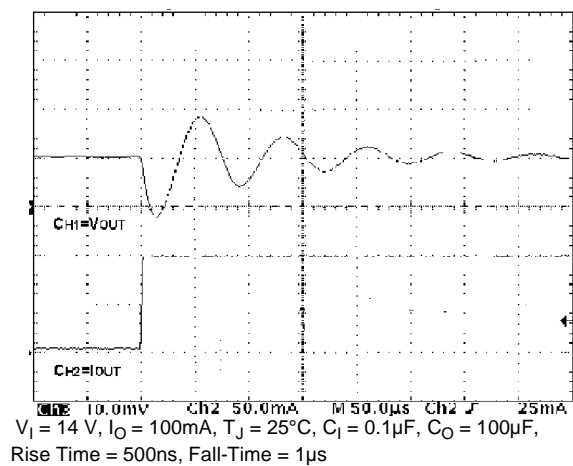


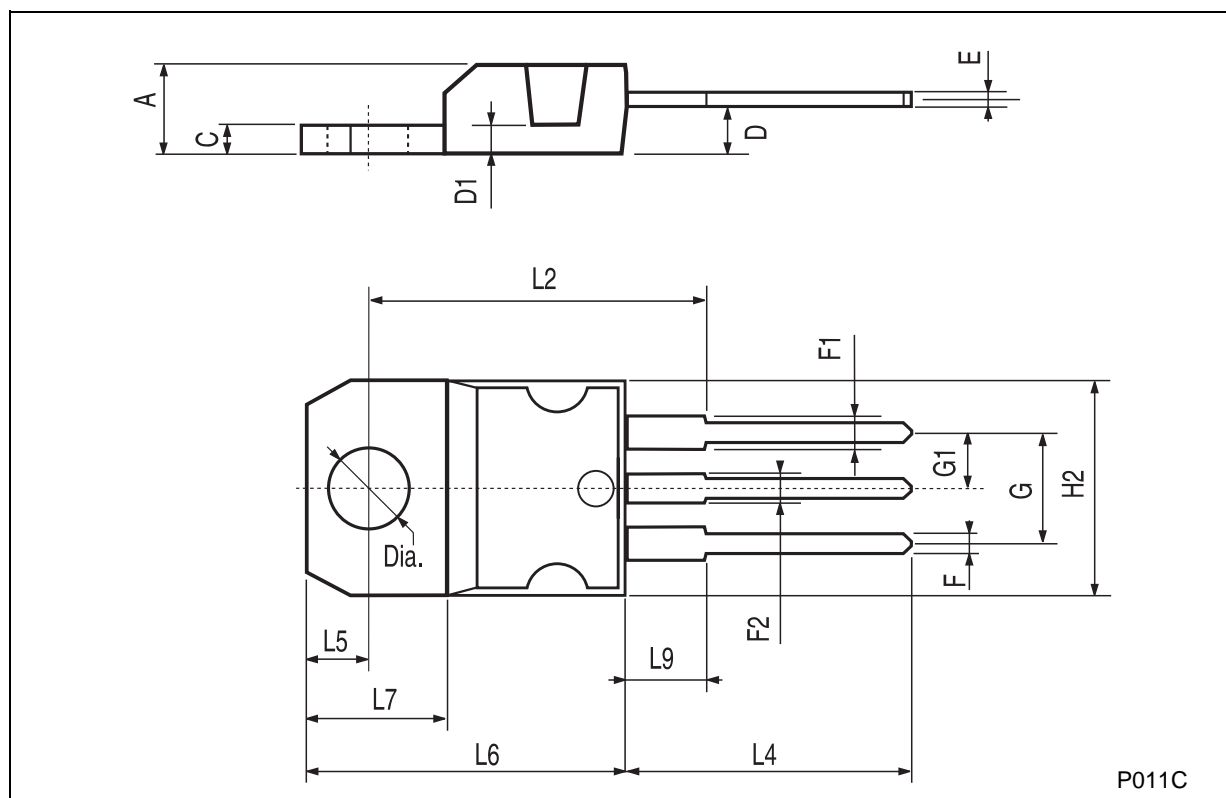
Figure 22: Line Transient



**Figure 23: Load Transient**

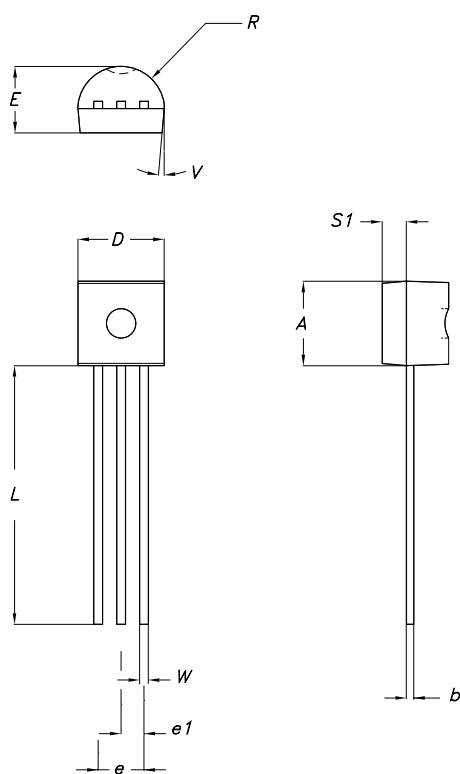
## TO-220 MECHANICAL DATA

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

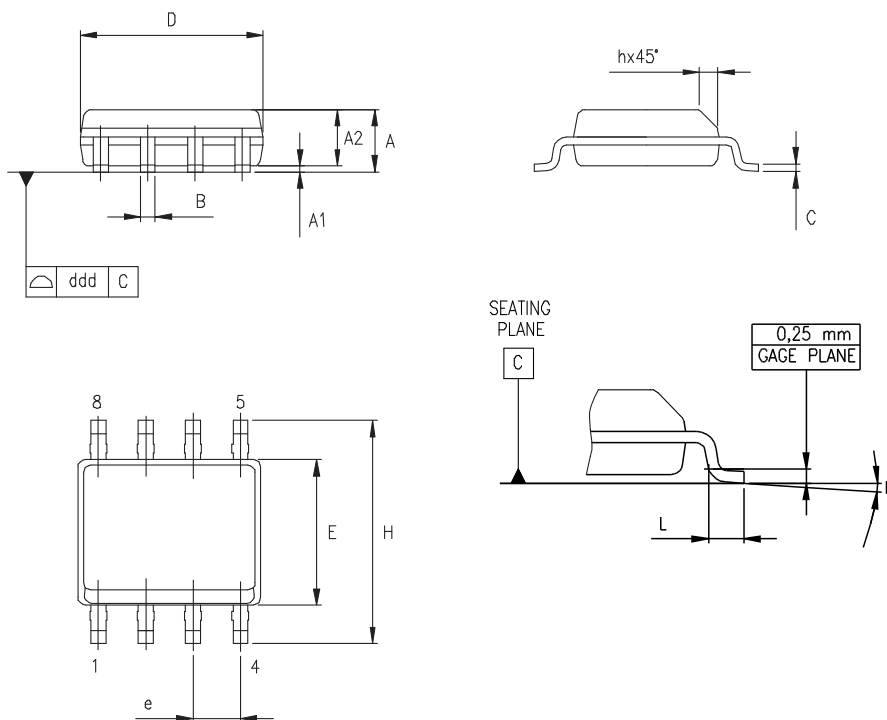
DIM.	mm.			mils		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.32		4.95	170.1		194.9
b	0.36		0.51	14.2		20.1
D	4.45		4.95	175.2		194.9
E	3.30		3.94	129.9		155.1
e	2.41		2.67	94.9		105.1
e1	1.14		1.40	44.9		55.1
L	12.7		15.49	500.0		609.8
R	2.16		2.41	85.0		94.9
S1	0.92		1.52	36.2		59.8
W	0.41		0.56	16.1		22.0
$\alpha$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



0102782/D

## SO-8 MECHANICAL DATA

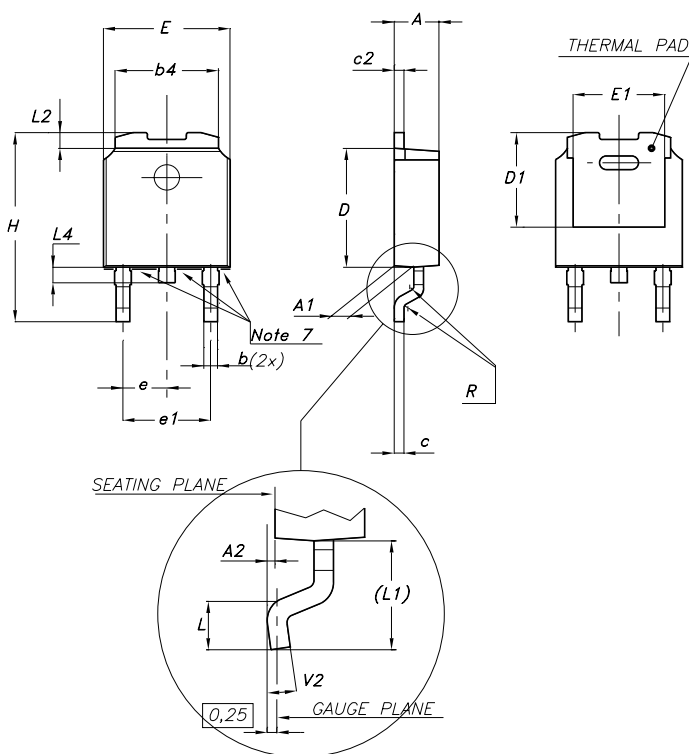
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020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



0016023/C

## 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

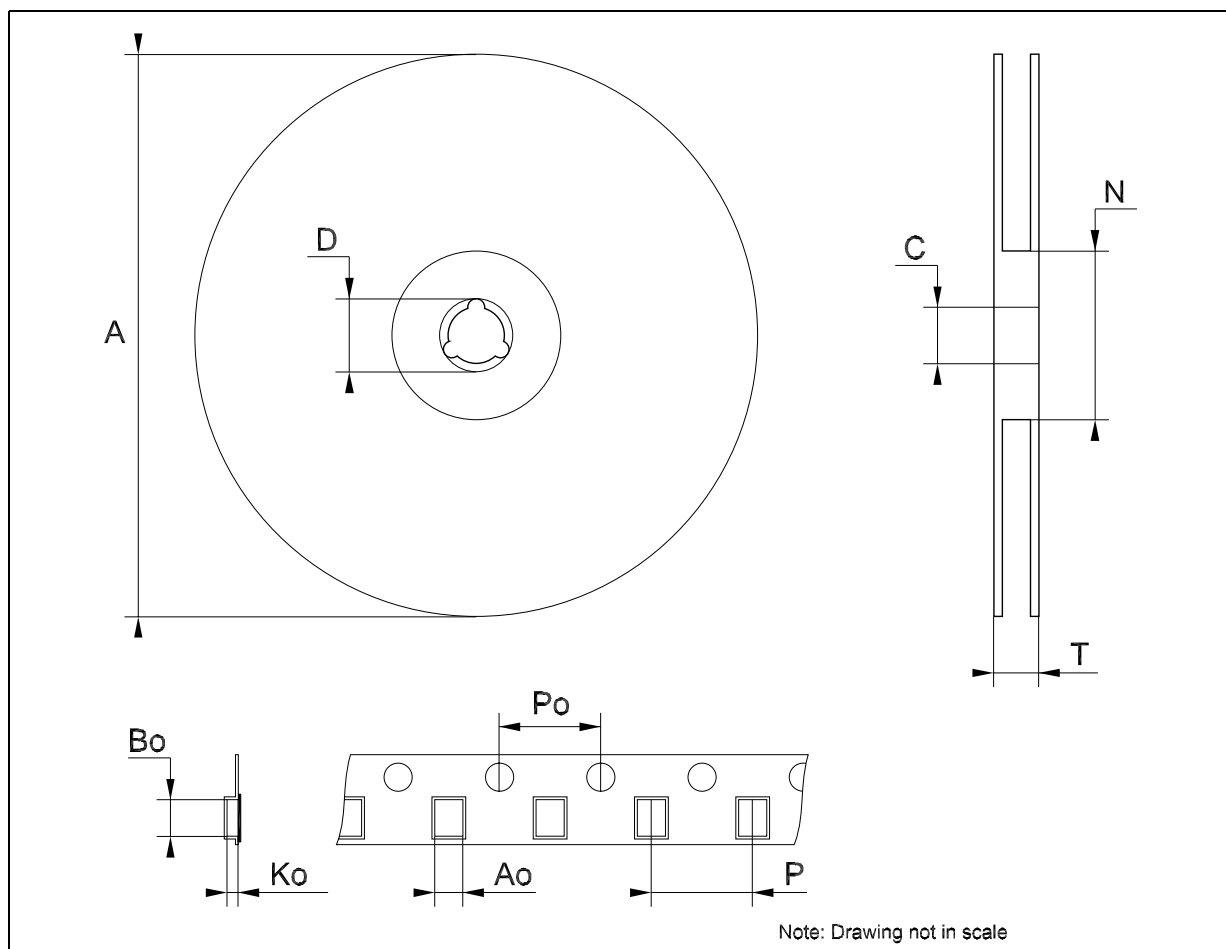


0068772-F



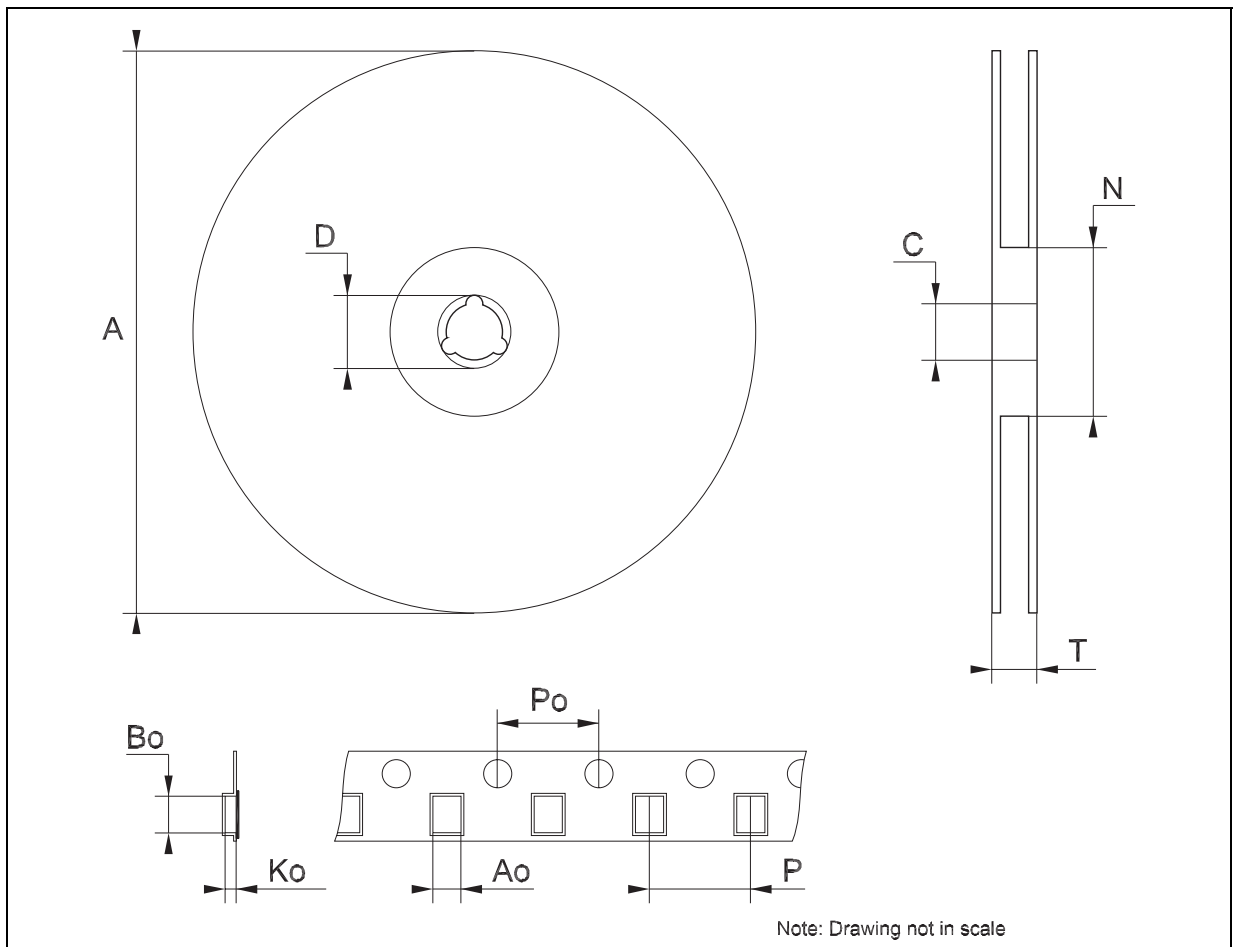
## Tape &amp; Reel DPAK-PPAK MECHANICAL DATA

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**

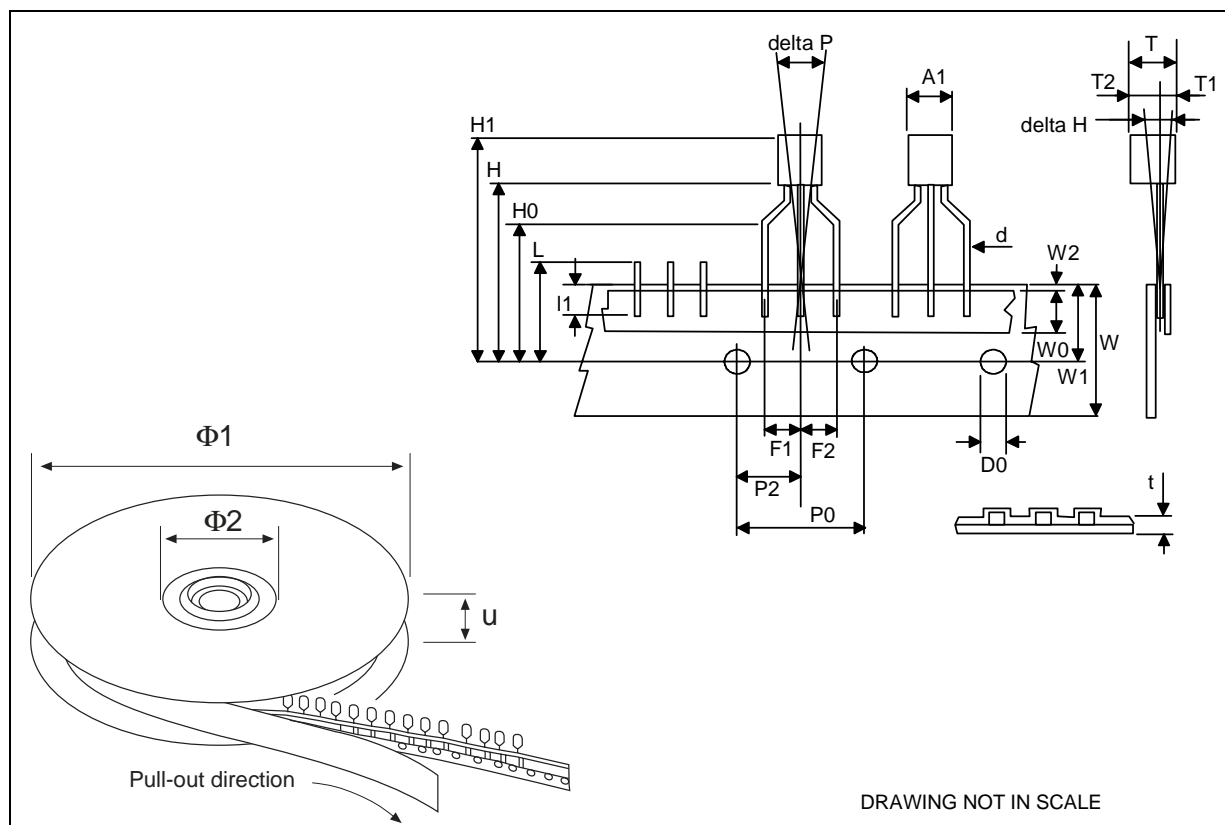
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	8.1		8.5	0.319		0.335
Bo	5.5		5.9	0.216		0.232
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



Note: Drawing not in scale

## Tape &amp; 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	



**Table 9: Revision History**

<b>Date</b>	<b>Revision</b>	<b>Description of Changes</b>
15-Mar-2005	11	Add Tape & Reel for TO-92.
23-Dec-2005	12	Mistake on Ordering Table in Header.

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