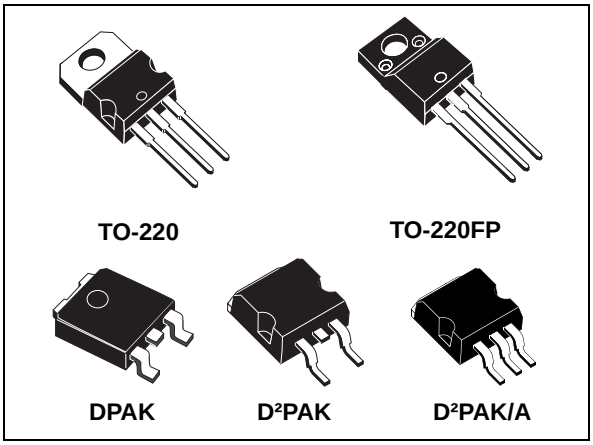
LD1085xx

3 A low drop positive voltage regulator: adjustable and fixed

Datasheet - production data



Features

- Typical dropout 1.3 V (at 3 A)
- Three terminal adjustable or fixed output voltage 1.8 V, 2.5 V, 3.3 V, 5 V, 12 V
- Automotive grade product: adjustable V_{OUT} only in TO-220 full pack package
- Guaranteed output current up to 3 A
- Output tolerance ± 1% at 25 °C and ± 2% in full temperature range
- Internal power and thermal limit
- Wide operating temperature range -40 °C to 125 °C
- Package available: TO-220, TO-220FP, DPAK, D²PAK, D²PAK/A
- Pinout compatibility with standard adjustable VREG

Description

The LD1085xx is a low drop voltage regulator able to provide up to 3 A of output current. Dropout is guaranteed at a maximum of 1.2 V at the maximum output current, decreasing at lower loads. The LD1085xx is pin-to-pin compatible with the older 3-terminal adjustable regulators, but offers better performance in terms of drop and output tolerance.

A 2.85 V output version is suitable for SCSI-2 active termination. Unlike PNP regulators, where a part of the output current is wasted as quiescent current, the LD1085xx quiescent current flows into the load, thus increase efficiency. Only a 10 µF minimum capacitor is need for stability.

The device is supplied in TO-220, TO-220FP, DPAK, D²PAK and D²PAK/A packages. On-chip trimming allows the regulator to reach a very tight output voltage tolerance, within ± 1% at 25 °C.

The LD1085xx is available as automotive grade in the TO-220FP package only, in the adjustable output voltage version using the commercial part number provided in the Order codes table. This device is qualified for the automotive market in accordance with specification AEC-Q100, in the temperature range of -40 °C to 125 °C, and statistical tests PAT, SYL, SBL have been performed.

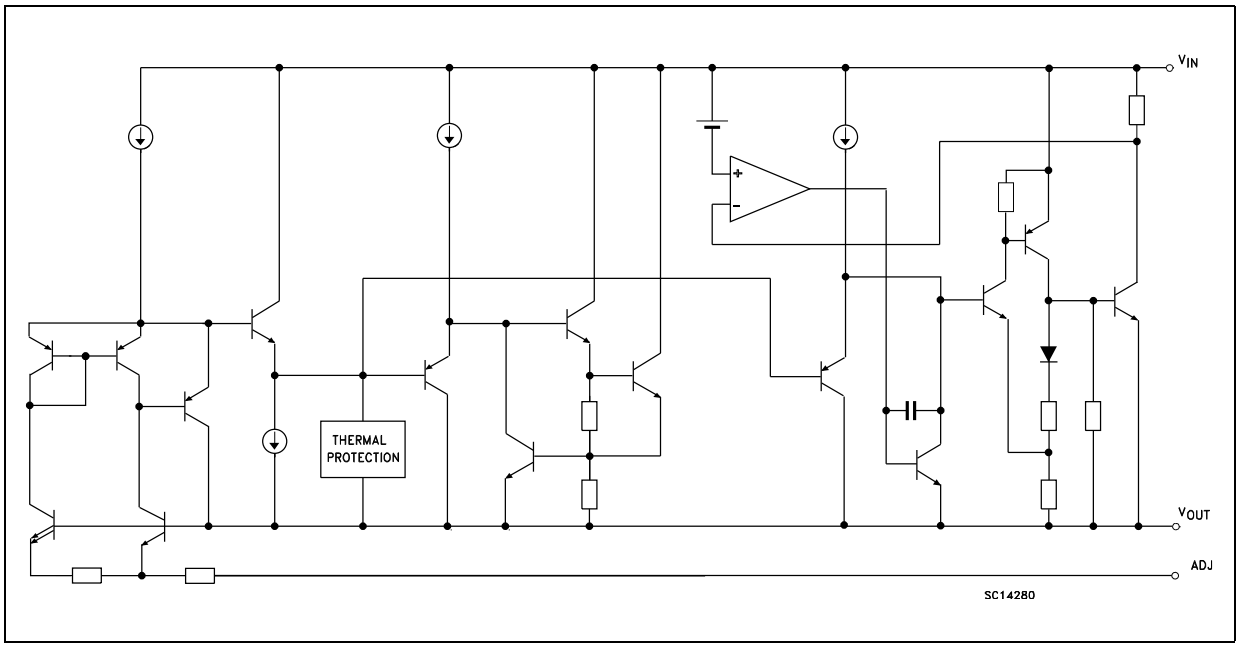
Table 1. Device summary

Part numbers	
LD1085XX	LD1085XX33
LD1085XX18	LD1085XX50
LD1085XX25	

Contents

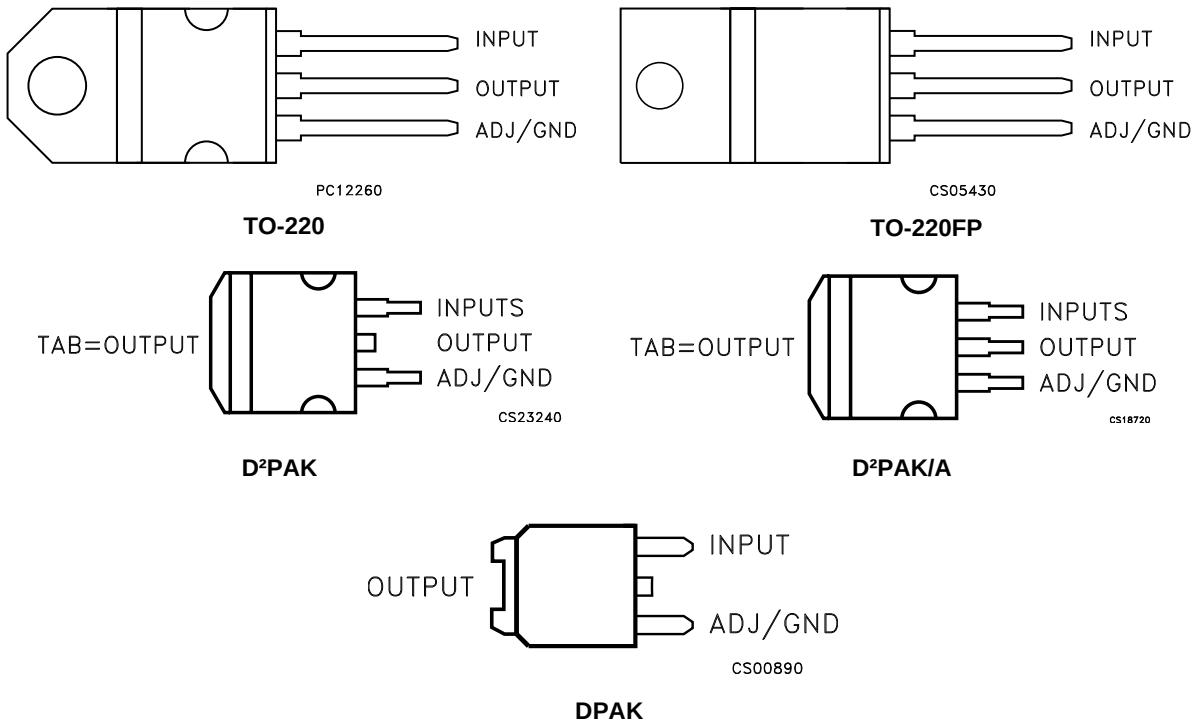
1 Diagram

Figure 1. Schematic diagram



2 Pin configuration

Figure 2. Pin connections (top view)



3 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_I	DC input voltage	30	V
I_O	Output current	Internally limited	mA
P_D	Power dissipation	Internally limited	mW
T_{STG}	Storage temperature range	-55 to +150	°C
T_{OP}	Operating junction temperature range	-40 to +125	°C

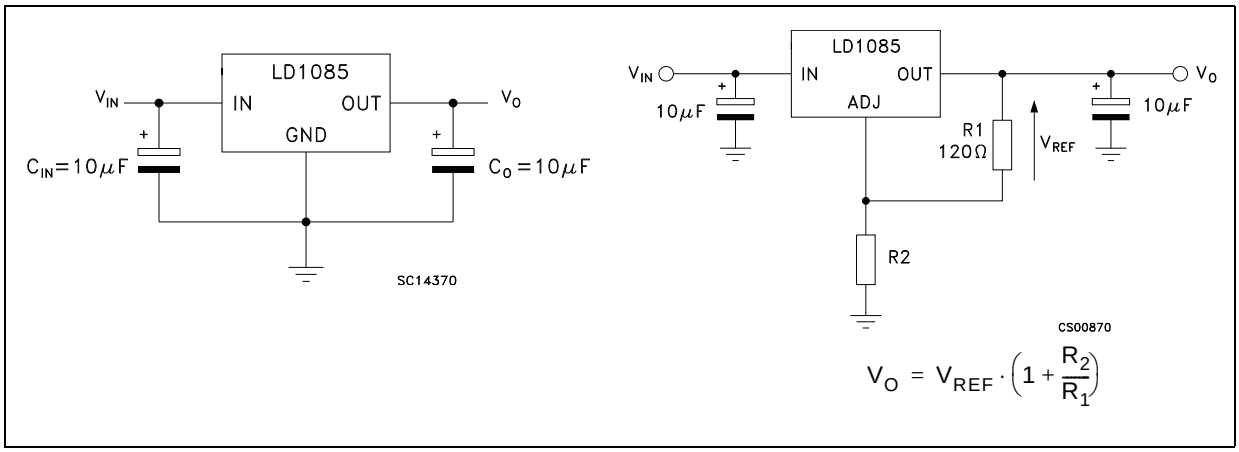
Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied

Table 3. Thermal data

Symbol	Parameter	TO-220	TO-220FP	DPAK	D²PAK D²PAK/A	Unit
R_{thJC}	Thermal resistance junction-case	3	5	8	3	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	60	100	62.5	°C/W

4 Application schematic

Figure 3. Application circuit



5 Electrical characteristics

V_I = 4.8 V, C_I = C_O =10 µF, T_A = -40 to 125 °C, unless otherwise specified.

Table 4. Electrical characteristics of LD1085#18

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_O	Output voltage (1)	I_O = 0 mA, T_J = 25°C	1.782	1.8	1.818	V
		I_O = 0 to 3 A, V_I = 3.4 to 30 V	1.764	1.8	1.836	V
ΔV_O	Line regulation	I_O = 0 mA, V_I = 3.4 to 18 V T_J = 25°C		0.2	4	mV
		I_O = 0 mA, V_I = 3.4 to 15 V		0.4	4	mV
ΔV_O	Load regulation	I_O = 0 to 3 A, T_J = 25°C		2	10	mV
		I_O = 0 to 3 A		4	20	mV
V_d	Dropout voltage	I_O = 3 A		1.3	1.5	V
I_q	Quiescent current	$V_I \leq$ 30 V		5	10	mA
I_{sc}	Short-circuit current	V_I - V_O = 5 V	3.2	4.5		A
		V_I - V_O = 25 V	0.2	0.5		A
	Thermal regulation	T_A = 25°C, 30 ms pulse		0.008	0.04	%/W
SVR	Supply voltage rejection	f = 120 Hz, C_O = 25 µF, I_O = 3 A V_I = 7.5 ± 3 V	60	72		dB
eN	RMS output noise voltage (% of V_O)	T_A = 25°C, f =10 Hz to 10 kHz		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	T_A = 125°C, 1000 Hrs		0.5		%

1. See short-circuit current curve for available output current at fixed dropout.

V_I = 5.5 V, C_I = C_O =10 µF, T_A = -40 to 125 °C, unless otherwise specified.

Table 5. Electrical characteristics of LD1085#25

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_O	Output voltage (1)	I_O = 0 mA, T_J = 25°C	2.475	2.5	2.525	V
		I_O = 0 to 3 A, V_I = 4.1 to 30 V	2.45	2.5	2.55	V
ΔV_O	Line regulation	I_O = 0 mA, V_I = 4.1 to 18 V, T_J = 25°C		0.2	4	mV
		I_O = 0 mA, V_I = 4.1 to 18 V		0.4	4	mV
ΔV_O	Load regulation	I_O = 0 to 3 A, T_J = 25°C		2	10	mV
		I_O = 0 to 3 A		4	20	mV
V_d	Dropout voltage	I_O = 3 A		1.3	1.5	V
I_q	Quiescent current	$V_I \leq$ 30 V		5	10	mA
I_{sc}	Short-circuit current	V_I - V_O = 5 V	3.2	4.5		A
		V_I - V_O = 25 V	0.2	0.5		A
	Thermal regulation	T_A = 25°C, 30ms pulse		0.008	0.04	%/W
SVR	Supply voltage rejection	f = 120 Hz, C_O = 25µF, I_O = 3 A V_I = 7.5 ± 3 V	60	72		dB
eN	RMS output noise voltage (% of V_O)	T_A = 25°C, f =10 Hz to 10 kHz		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	T_A = 125°C, 1000 Hrs		0.5		%

1. See short-circuit current curve for available output current at fixed dropout.

V_I = 6.3 V, C_I = C_O =10 µF, T_A = -40 to 125 °C, unless otherwise specified.

Table 6. Electrical characteristics of LD1085#33

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_O	Output voltage (1)	I_O = 0 mA, T_J = 25°C	3.267	3.3	3.333	V
		I_O = 0 to 3 A, V_I = 4.9 to 30 V	3.234	3.35	3.366	V
ΔV_O	Line regulation	I_O = 0 mA, V_I = 4.9 to 18 V, T_J = 25°C		0.5	6	mV
		I_O = 0 mA, V_I = 4.9 to 18 V		1	6	mV
ΔV_O	Load regulation	I_O = 0 to 3 A, T_J = 25°C		3	15	mV
		I_O = 0 to 3 A		7	20	mV
V_d	Dropout voltage	I_O = 3 A		1.3	1.5	V
I_q	Quiescent current	$V_I \leq$ 30 V		5	10	mA
I_{sc}	Short-circuit current	V_I - V_O = 5 V	3.2	4.5		A
		V_I - V_O = 25 V	0.2	0.5		A
	Thermal regulation	T_A = 25°C, 30 ms pulse		0.008	0.04	%/W
SVR	Supply voltage rejection	f = 120 Hz, C_O = 25 µF, I_O = 3 A V_I = 8.3 ± 3 V	60	72		dB
eN	RMS output noise voltage (% of V_O)	T_A = 25°C, f =10 Hz to 10 kHz		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	T_A = 125°C, 1000 Hrs		0.5		%

1. See short-circuit current curve for available output current at fixed dropout.

V_I = 8 V, C_I = C_O =10 µF, T_A = -40 to 125 °C, unless otherwise specified.

Table 7. Electrical characteristics of LD1085#50

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_O	Output voltage (1)	I_O = 0 mA, T_J = 25°C	4.95	5	5.05	V
		I_O = 0 to 3 A, V_I = 6.6 to 30 V	4.9	5	5.1	V
ΔV_O	Line regulation	I_O = 0 mA, V_I = 6.6 to 20 V, T_J = 25°C		0.5	10	mV
		I_O = 0 mA, V_I = 6.6 to 20 V		1	10	mV
ΔV_O	Load regulation	I_O = 0 to 3 A, T_J = 25°C		5	10	mV
		I_O = 0 to 3 A		10	35	mV
V_d	Dropout voltage	I_O = 3 A		1.3	1.5	V
I_q	Quiescent current	$V_I \leq$ 30 V		5	10	mA
I_{sc}	Short-circuit current	V_I - V_O = 5 V	3.2	4.5		A
		V_I - V_O = 25 V	0.2	0.5		A
	Thermal regulation	T_A = 25°C, 30 ms pulse		0.008	0.04	%/W
SVR	Supply voltage rejection	f = 120 Hz, C_O = 25 µF, I_O = 3 A V_I = 10 ± 3 V	60	72		dB
eN	RMS output noise voltage (% of V_O)	T_A = 25°C, f = 10 Hz to 10 kHz		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	T_A = 125°C, 1000 Hrs		0.5		%

1. See short-circuit current curve for available output current at fixed dropout.

V_I = 4.25 V, C_I = C_O =10 µF, T_A = -40 to 125 °C, unless otherwise specified.

Table 8. Electrical characteristics of LD1085#

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_{ref}	Reference voltage (1)	I_O = 10 mA T_J = 25°C	1.237	1.25	1.263	V
		I_O = 10 mA to 3 A, V_I = 2.85 to 30 V	1.225	1.25	1.275	V
ΔV_O	Line regulation	I_O = 10 mA, V_I = 2.85 to 16.5 V, T_J = 25°C		0.015	0.2	%
		I_O = 10 mA, V_I = 2.85 to 16.5 V		0.035	0.2	%
ΔV_O	Load regulation	I_O = 10 mA to 3 A, T_J = 25°C		0.1	0.3	%
		I_O = 0 to 3 A		0.2	0.4	%
V_d	Dropout voltage	I_O = 3 A		1.3	1.5	V
$I_{O(min)}$	Minimum load current	V_I = 30 V		3	10	mA
I_{sc}	Short-circuit current	V_I - V_O = 5 V	5.5	6.5		A
		V_I - V_O = 25 V	0.5	0.7		A
	Thermal regulation	T_A = 25°C, 30ms pulse		0.003	0.015	%/W
SVR	Supply voltage rejection	f = 120 Hz, C_O = 25 µF,C_{ADJ} = 25 µF, I_O = 3 A, V_I = 6.25 ± 3 V	60	72		dB
I_{ADJ}	Adjust pin current	V_I = 4.25 V, I_O = 10 mA		55	120	µA
ΔI_{ADJ}	Adjust pin current change (1)	I_O = 10 mA to 3 A, V_I = 2.85 to 16.5 V		0.2	5	µA
eN	RMS output noise voltage (% of V_O)	T_A = 25°C, f =10 Hz to 10 kHz		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	T_A = 125°C, 1000 Hrs		0.5		%

1. See short-circuit current curve for available output current at fixed dropout.

V_I = 4.25 V, C_I = C_O =10 µF, T_A = -40 to 125 °C, unless otherwise specified.

Table 9. Electrical characteristics of LD1085PY (Automotive Grade)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_{ref}	Reference voltage (1)	I_O = 10 mA T_A = 25°C	1.237	1.25	1.263	V
		I_O = 10 mA to 3 A, V_I = 2.85 to 30 V	1.225	1.25	1.275	V
ΔV_O	Line regulation	I_O = 10 mA, V_I = 2.85 to 16.5 V		0.035	0.2	%
ΔV_O	Load regulation	I_O = 0 to 3 A		0.2	0.4	%
V_d	Dropout voltage	I_O = 3 A		1.3	1.5	V
$I_{O(min)}$	Minimum load current	V_I = 30 V		3	10	mA
I_{sc}	Short-circuit current	V_I - V_O = 5 V, T_A = 25°C	5.5	6.5		A
		V_I - V_O = 25 V, T_A = 25°C	0.5	0.7		A
	Thermal regulation	T_A = 25°C, 30 ms pulse		0.003	0.015	%/W
SVR	Supply voltage rejection	f = 120 Hz, C_O = 25 µF,C_{ADJ} = 25 µF, I_O = 3 A, V_I = 6.25 ± 3 V, T_A = 25°C	60	72		dB
I_{ADJ}	Adjust pin current	V_I = 4.25 V, I_O = 10 mA		55	120	µA
ΔI_{ADJ}	Adjust pin current change (1)	I_O = 10 mA to 3 A, V_I = 2.85 to 16.5 V		0.2	5	µA
eN	RMS output noise voltage (% of V_O)	T_A = 25°C, f =10 Hz to 10 kHz		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	T_A = 125°C, 1000 Hrs		0.5		%

1. See short-circuit current curve for available output current at fixed dropout.

6 Typical application

Unless otherwise specified T_J = 25 °C, C_I = C_O = 10 µF.

Figure 4. Output voltage vs. temp. (I_O = 3 A)

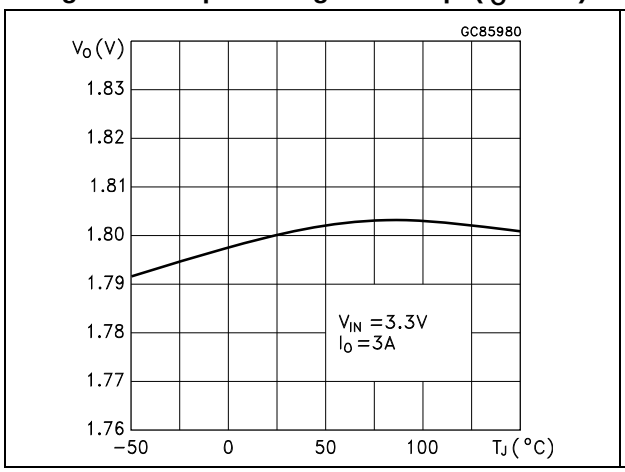


Figure 5. Output voltage vs. temp. (I_O = 0 mA)

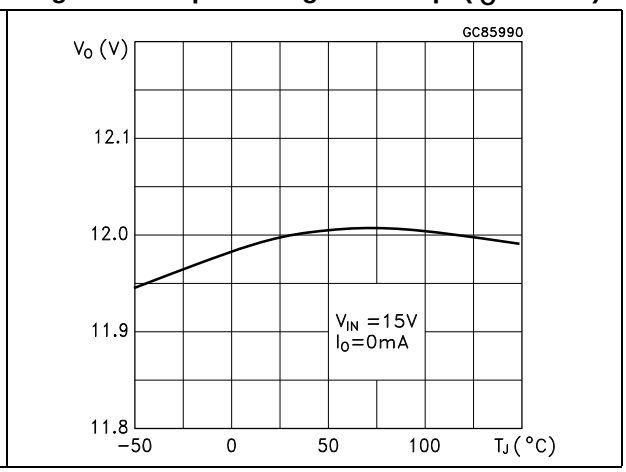


Figure 6. Output voltage vs. temp. (I_O = 10 mA)

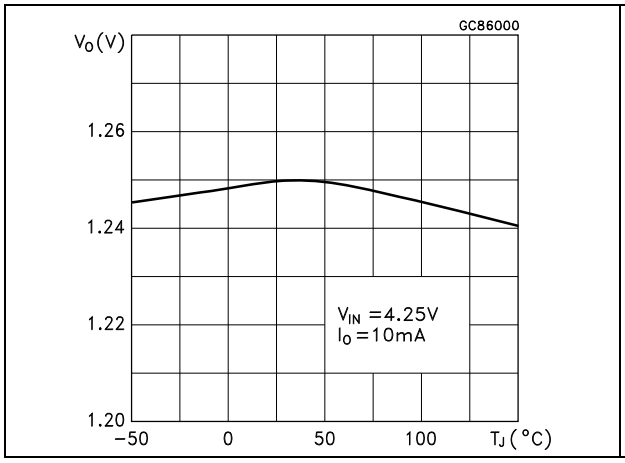


Figure 7. Short-circuit current vs. dropout voltage

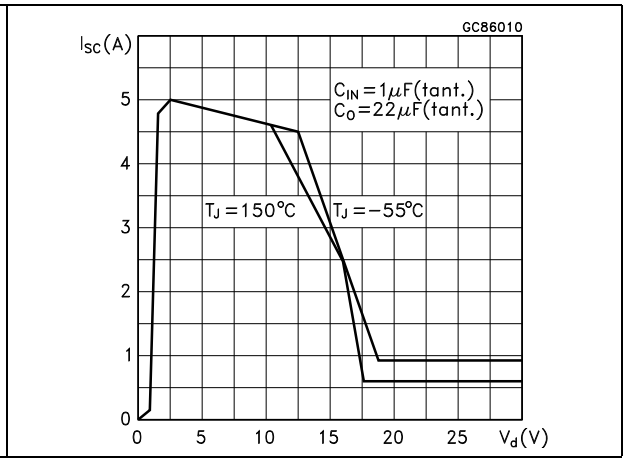


Figure 8. Line regulation vs. temp. (I_O = 10 mA)

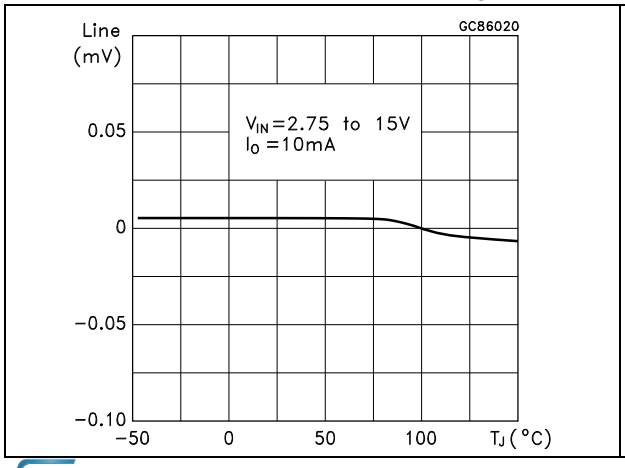


Figure 9. Load regulation vs. temperature

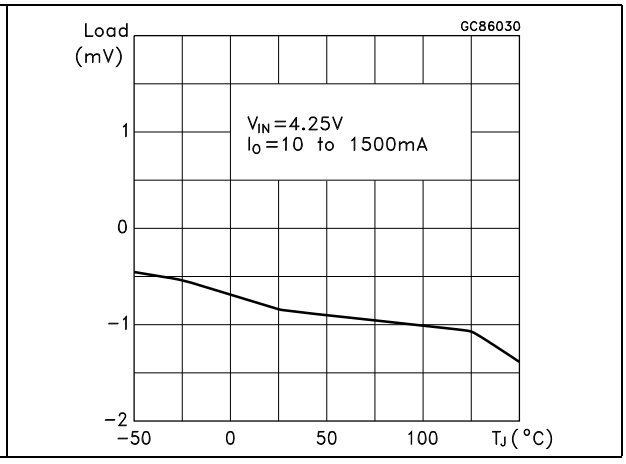


Figure 10. Dropout voltage vs. temperature

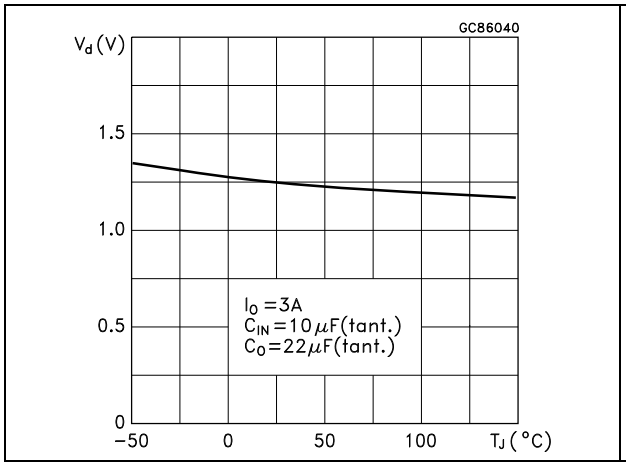


Figure 11. Dropout voltage vs. output current

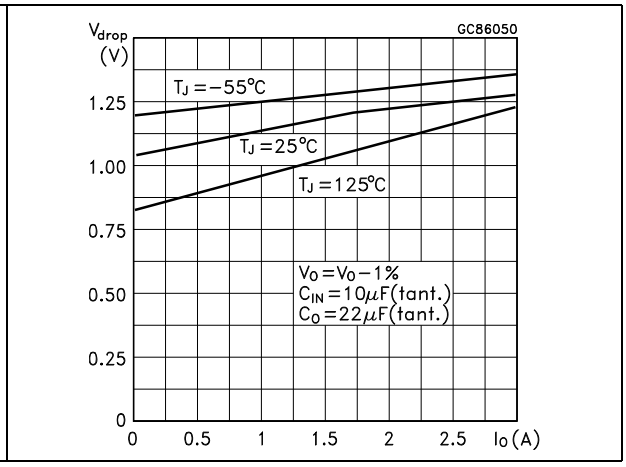


Figure 12. Adjust pin current vs. temperature

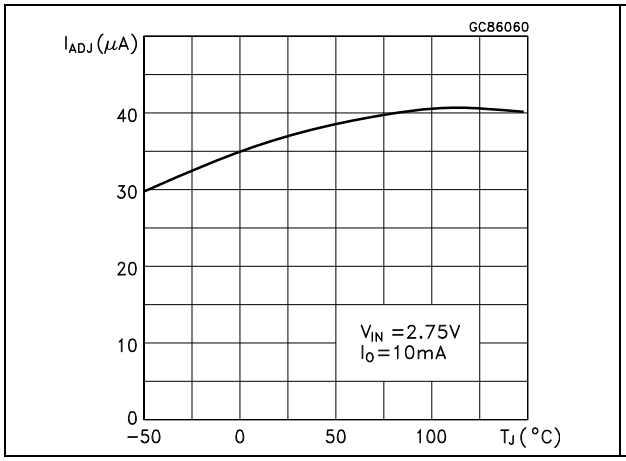


Figure 13. Quiescent current vs. temperature

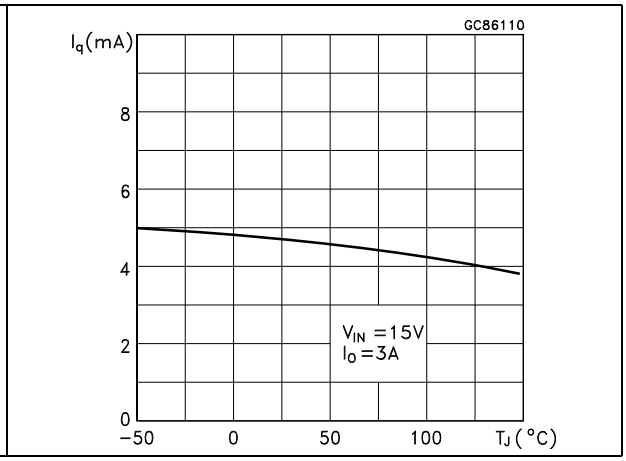


Figure 14. Line regulation vs. temperature (V_{IN} = 15 V)

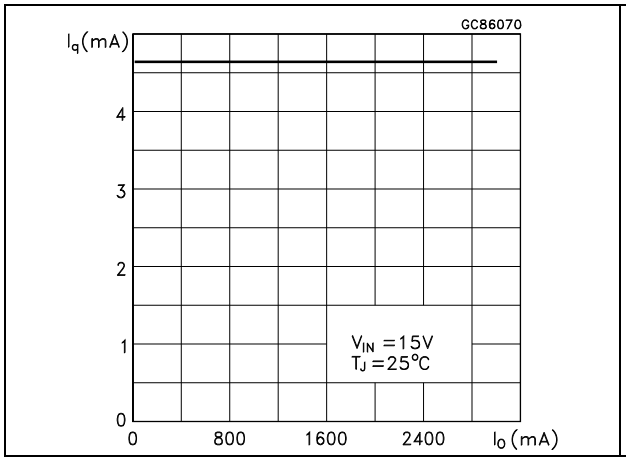


Figure 15. Supply voltage rejection vs. output current

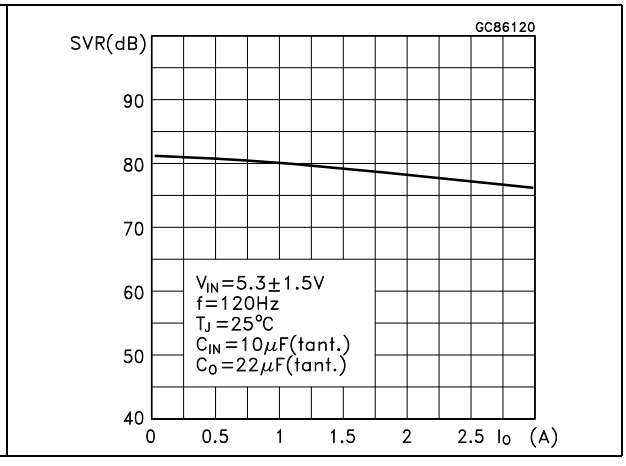


Figure 16. Supply voltage rejection vs. frequency

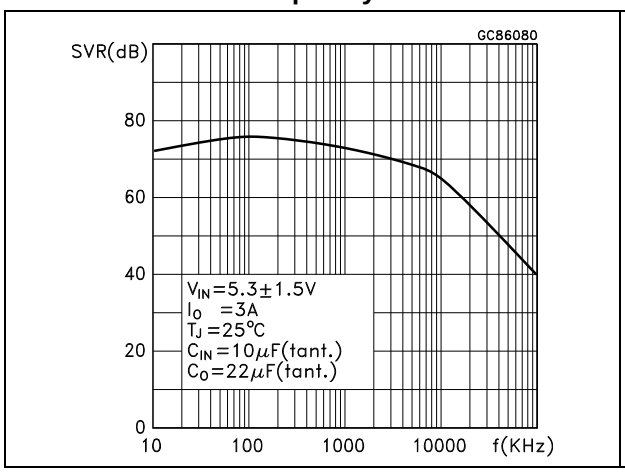


Figure 17. Supply voltage rejection vs. temperature

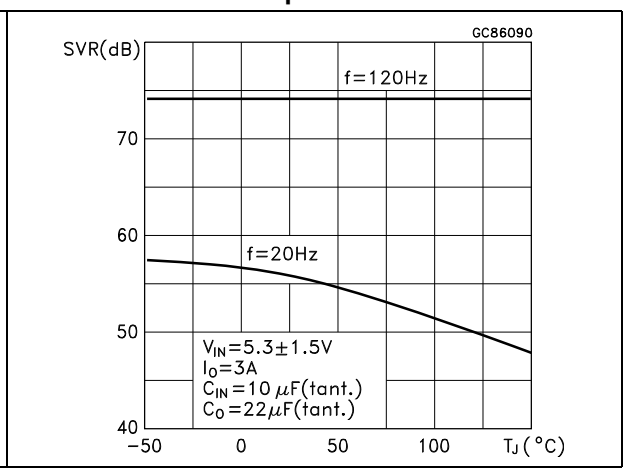


Figure 18. Minimum load current vs. temperature

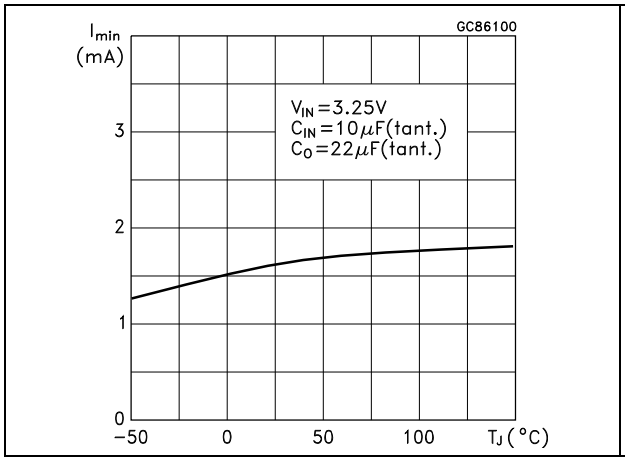


Figure 19. Stability, V_O = 1.8 V

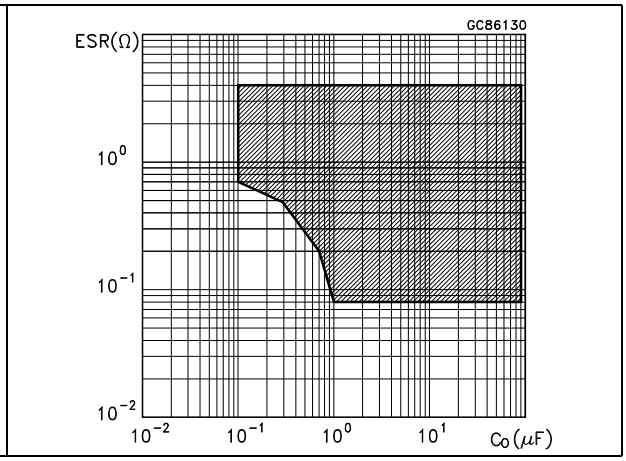


Figure 20. Stability, V_O = 12 V

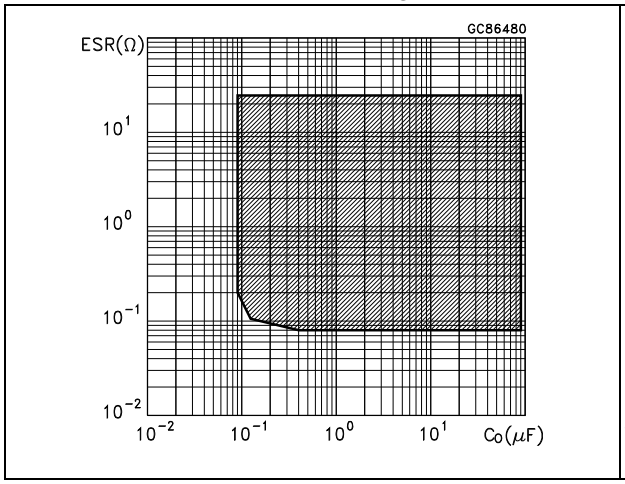
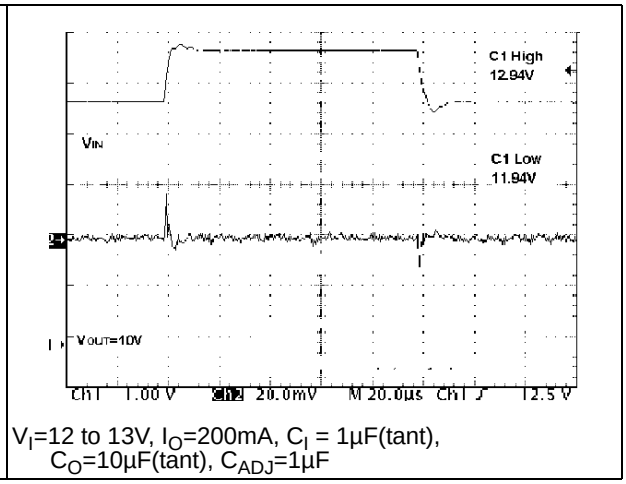
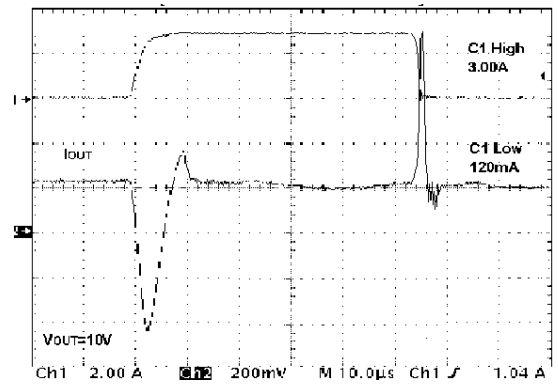


Figure 21. Line transient



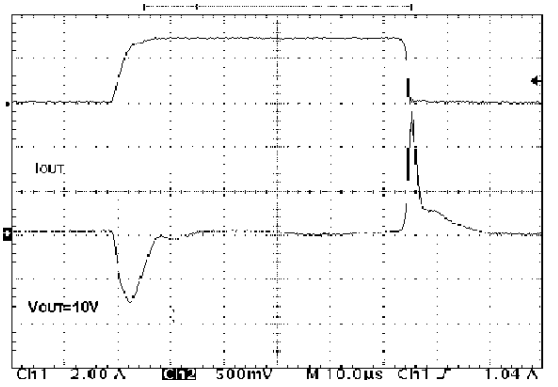
V_I=12 to 13V, I_O=200mA, C_I = 1µF(tant), C_O=10µF(tant), C_{ADJ}=1µF

Figure 22. Load transient (Ch2 = 200 mV)



V_I=12V, I_O=0.12 to 3A, C_I = 1µF(tant), C_O=10µF(tant), C_{ADJ}=1µF

Figure 23. Load transient (Ch2 = 500 mV)



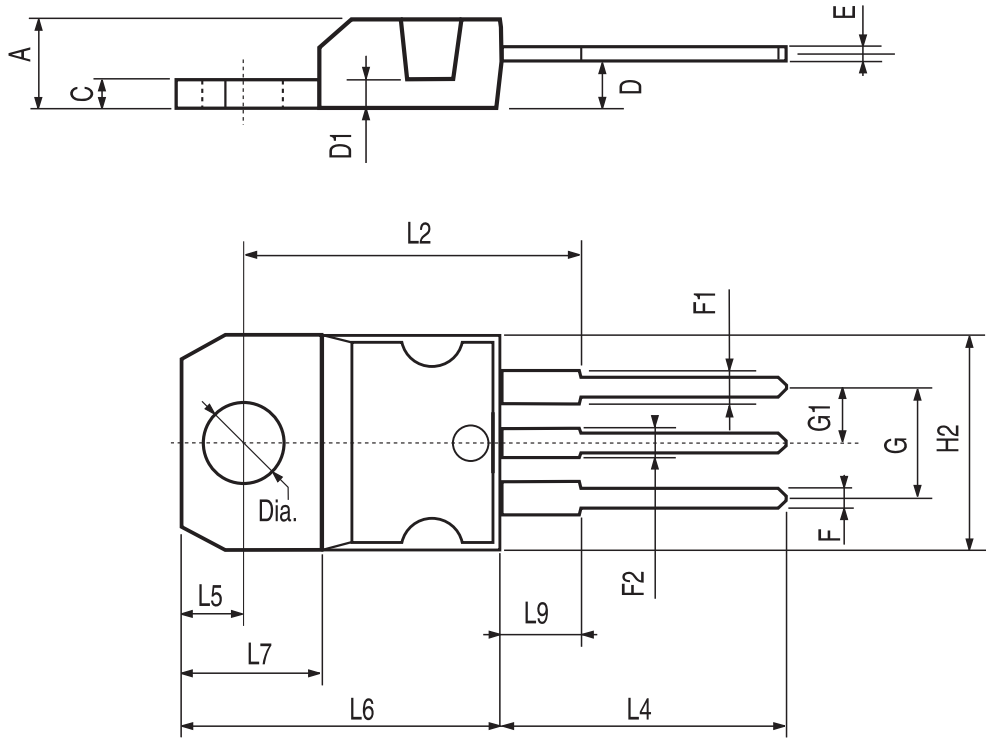
V_I=12V, I_O=0.12 to 3A, C_I = 1µF(tant), C_O=10µF(tant), C_{ADJ}=1µF

7 Package mechanical data

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.

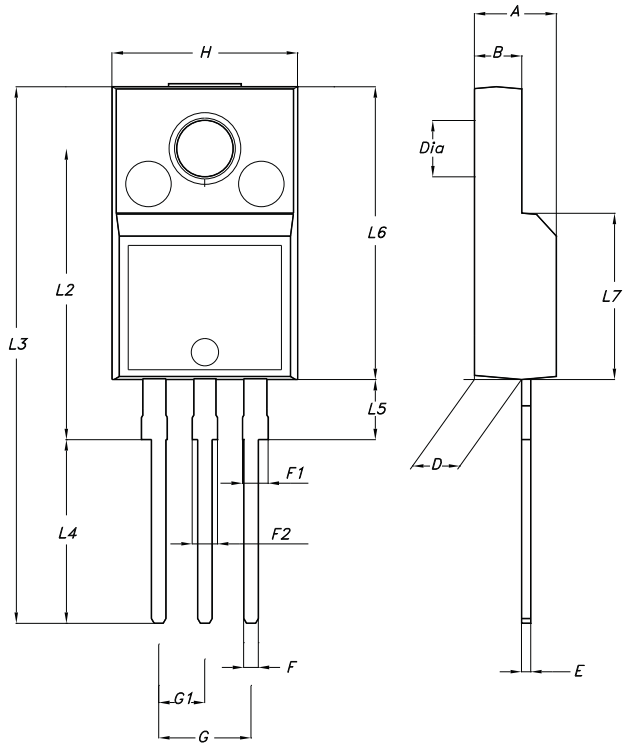
TO-220 mechanical data

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-220FP mechanical data

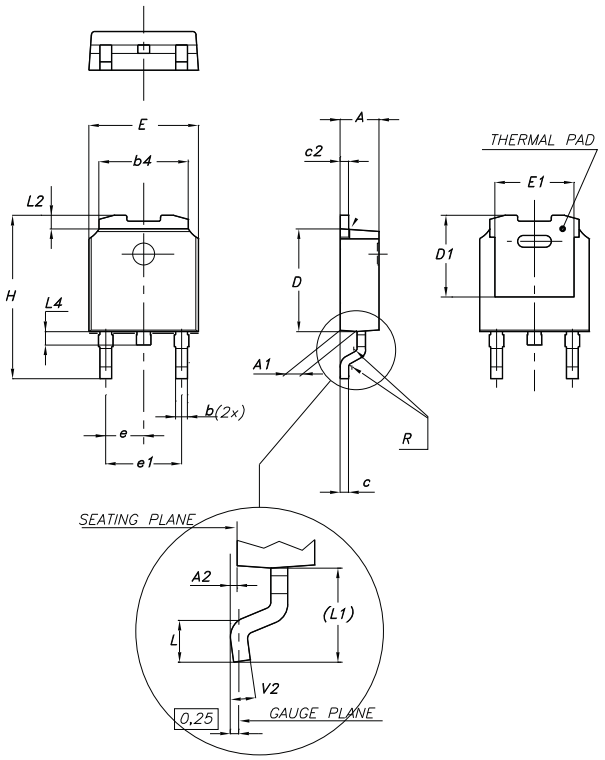
Dim.	mm.			inch.		
	Min.	Typ	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.70	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.50	0.045		0.059
F2	1.15		1.50	0.045		0.059
G	4.95		5.2	0.194		0.204
G1	2.4		2.7	0.094		0.106
H	10.0		10.40	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
L5	2.9		3.6	0.114		0.142
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
DIA.	3		3.2	0.118		0.126



7012510A-H

DPAK mechanical data

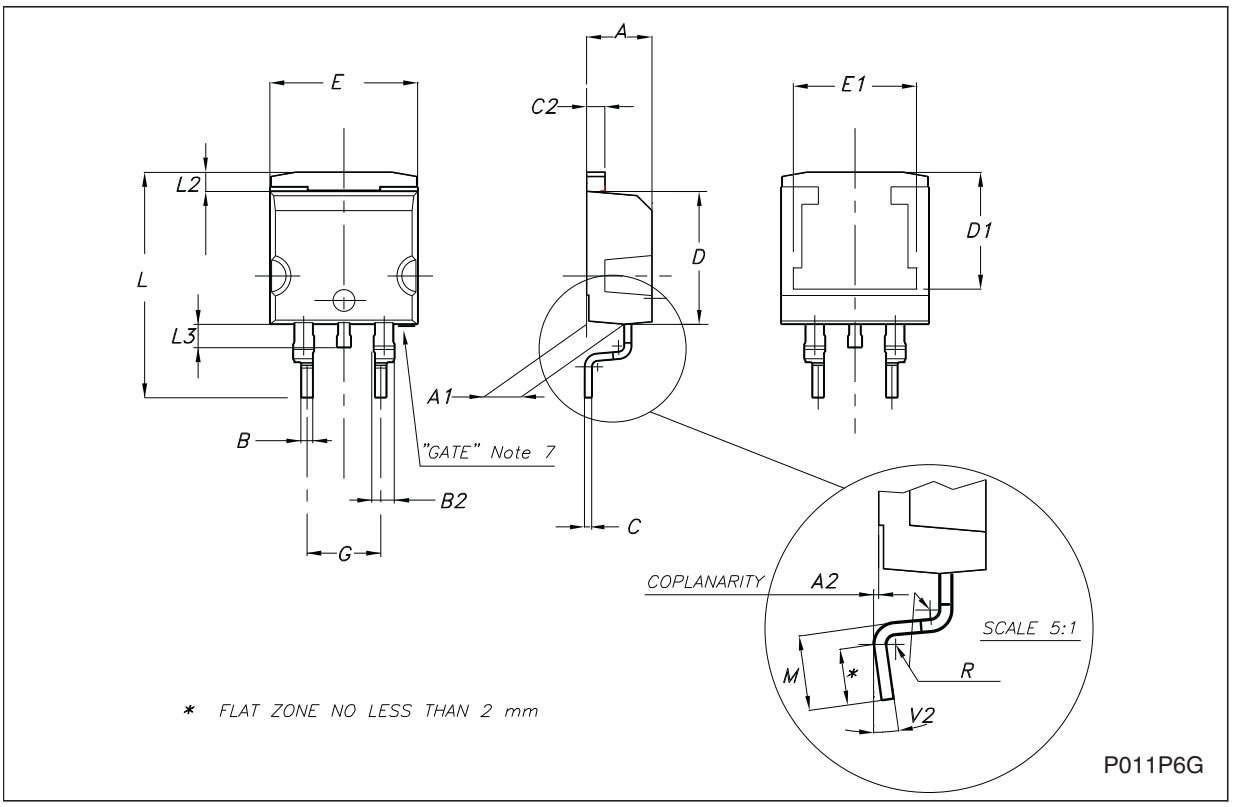
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
D1		5.1			0.200	
E	6.4		6.6	0.252		0.260
E1		4.7			0.185	
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

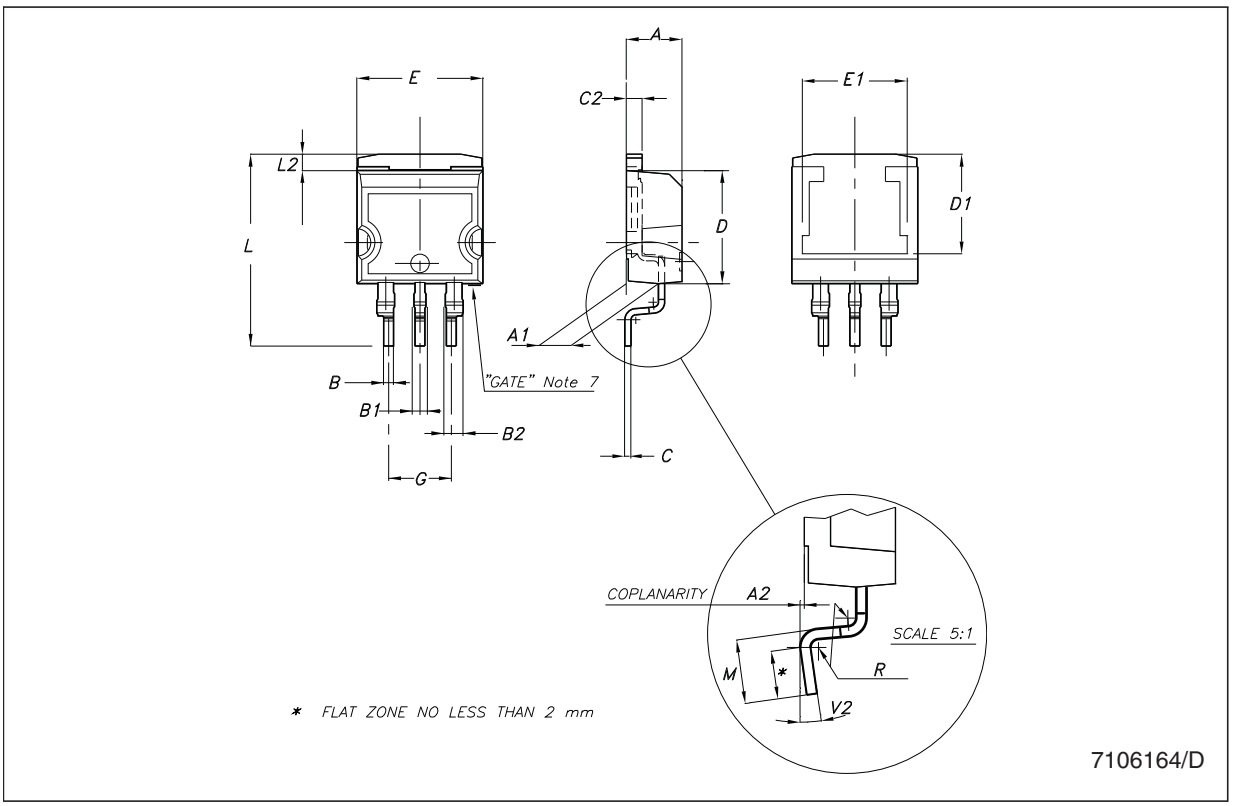
D²PAK mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		0.409
E1		8.5			0.335	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.624
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.016	
V2	0°		8°	0°		8°



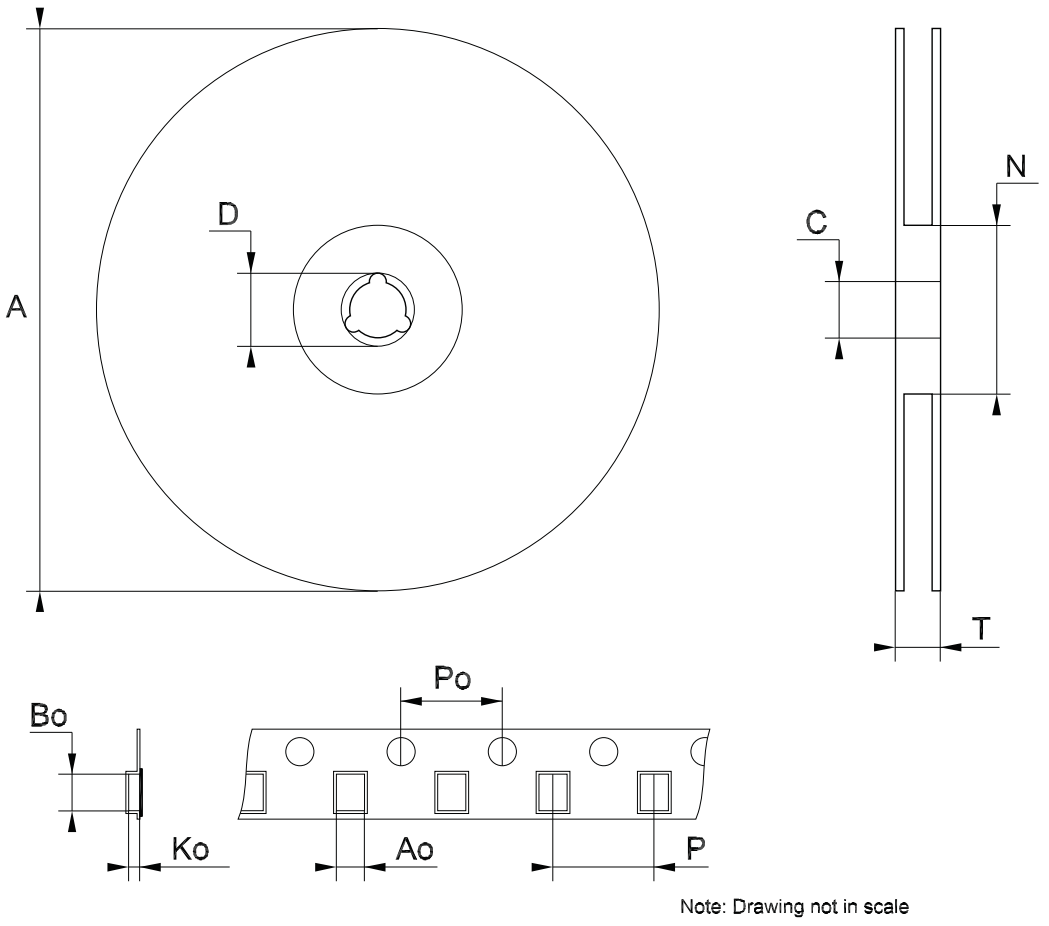
D^2PAK/A mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.028		0.037
B1	0.8		1.3	0.031		0.051
B2	1.14		1.7	0.045		0.067
C	0.45		0.60	0.018		0.024
C2	1.23		1.36	0.048		0.054
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.394		0.409
E1		8.5			0.335	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.591		0.624
L2	1.27		1.4	0.050		0.055
M	2.4		3.2	0.094		0.126
R		0.4			0.016	
V2	0°		8°	0°		8°



Tape & reel DPAK-PPAK mechanical data

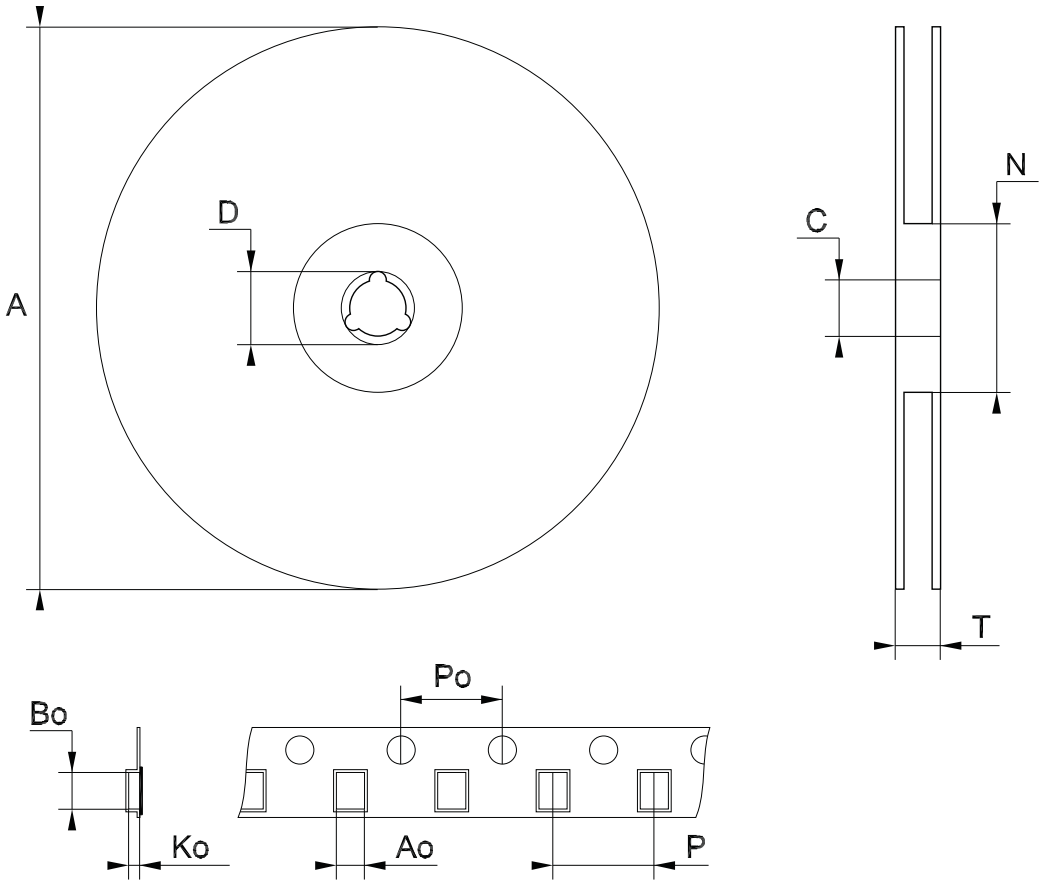
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.80	6.90	7.00	0.268	0.272	0.2.76
Bo	10.40	10.50	10.60	0.409	0.413	0.417
Ko	2.55	2.65	2.75	0.100	0.104	0.105
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	7.9	8.0	8.1	0.311	0.315	0.319



Note: Drawing not in scale

Tape & reel D^2PAK-P^2PAK-D^2PAK/A-P^2PAK/A mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			180			7.086
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			14.4			0.567
Ao	10.50	10.6	10.70	0.413	0.417	0.421
Bo	15.70	15.80	15.90	0.618	0.622	0.626
Ko	4.80	4.90	5.00	0.189	0.193	0.197
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	11.9	12.0	12.1	0.468	0.472	0.476



Note: Drawing not in scale

8 Order codes

Table 10. Order codes

Packages					Output voltage
TO-220	TO-220FP	D²PAK	DPAK (T&R)	D²PAK/A (T&R)	
				LD1085D2M18R	1.8 V
				LD1085D2M25R	2.5 V
		LD1085D2T33R		LD1085D2M33R	3.3 V
LD1085V50					5.0 V
LD1085V	LD1085P	LD1085D2T-R		LD1085D2M-R	ADJ
	LD1085PY (1)				ADJ

1. Automotive grade products.

9 Revision history

Table 11. Document revision history

Date	Revision	Changes
07-Oct-2004	12	Mistake order codes - Table 1.
08-Feb-2005	13	Mistake U.M. load regulation - V ==> mV.
01-Mar-2005	14	Version 1.2 V removed.
22-May-2006	15	Order codes has been updated and new template.
10-Nov-2006	16	Add package DPAK, typo on V_O test value in tables 3, 4 and 11.
04-Apr-2007	17	Order codes updated.
07-Jun-2007	18	Order codes updated.
05-Dec-2007	19	Modified: *Table 10*.
29-Jan-2008	20	Added new order codes for Automotive grade products see *Table 10 on page 25*.
18-Feb-2008	21	Modified: *Table 10 on page 25*.
09-Apr-2008	22	Modified: *Table 10 on page 25*.
14-Jul-2008	23	Modified: *Table 10 on page 25*.
22-Aug-2008	24	Modified: *Table 3 on page 5*.
28-Jul-2009	25	Modified: *Table 10 on page 25*.
18-Feb-2013	26	– Modified Output voltage in Voltage reference parameter *Table 8 on page 11* and *Table 9 on page 12*. – Minor text changes throughout the document.

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