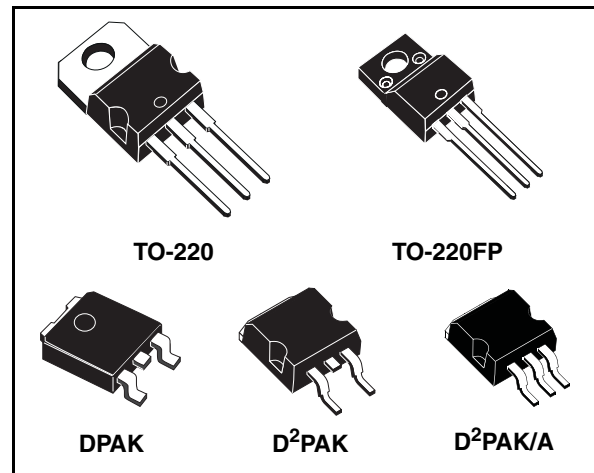


3A Low drop positive voltage regulator adjustable and fixed

Features

- Typical dropout 1.3V (at 3A)
- Three terminal adjustable or fixed output voltage 1.5V, 1.8V, 2.5V, 3.3V, 5V, 12V.
- Guaranteed output current up to 3A
- Output tolerance $\pm 1\%$ at 25°C and $\pm 2\%$ 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



better performances in term of drop and output tolerance.

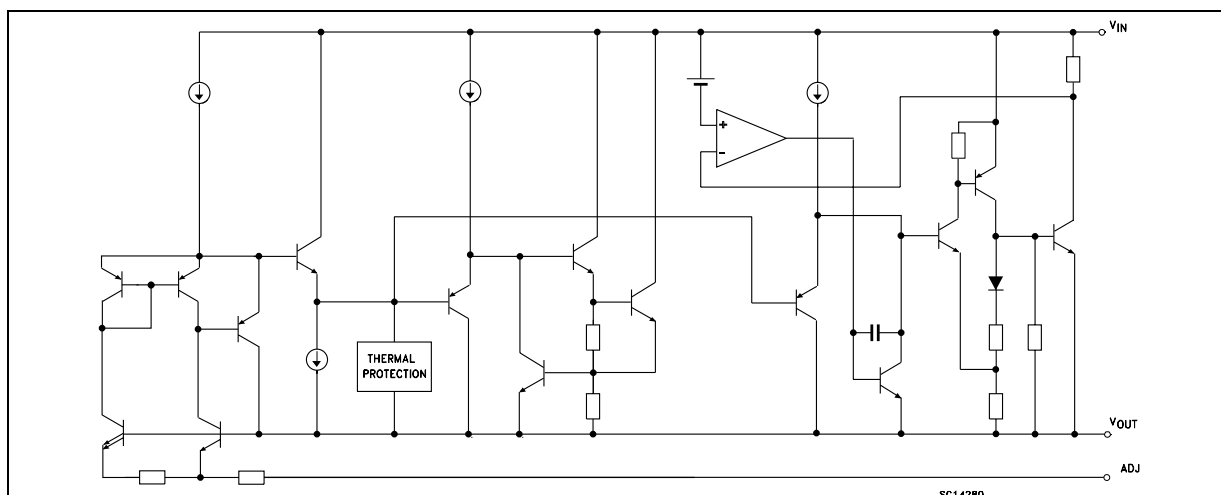
A 2.85V output version is suitable for SCSI-2 active termination. Unlike PNP regulators, where a part of the output current is wasted as quiescent current, the LD1085 quiescent current flows into the load, so increase efficiency. Only a 10 μ F minimum capacitor is need for stability.

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

Description

The LD1085 is a LOW DROP Voltage Regulator able to provide up to 3A of Output Current. Dropout is guaranteed at a maximum of 1.2V at the maximum output current, decreasing at lower loads. The LD1085 is pin to pin compatible with the older 3-terminal adjustable regulators, but has

Schematic diagram

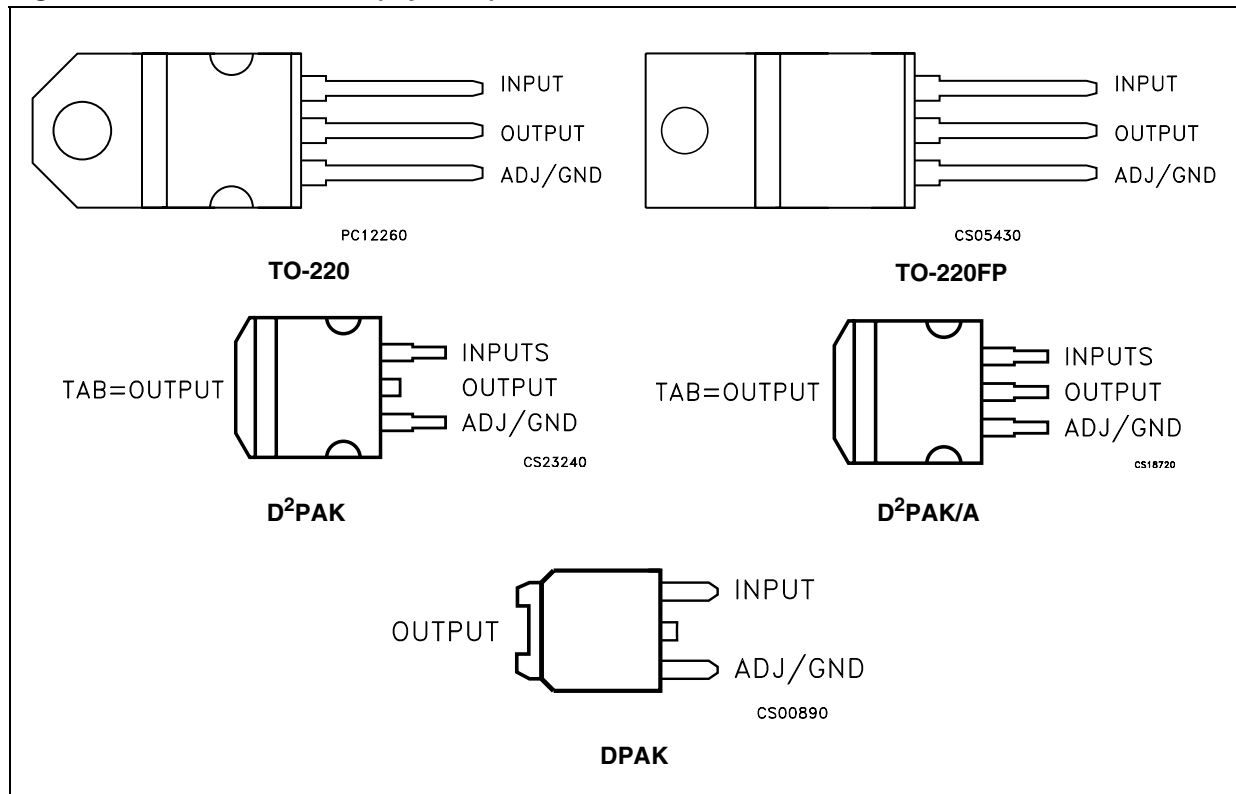


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1 Pin configuration

Figure 1. Pin connections (top view)



2 Maximum ratings

Table 1. 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

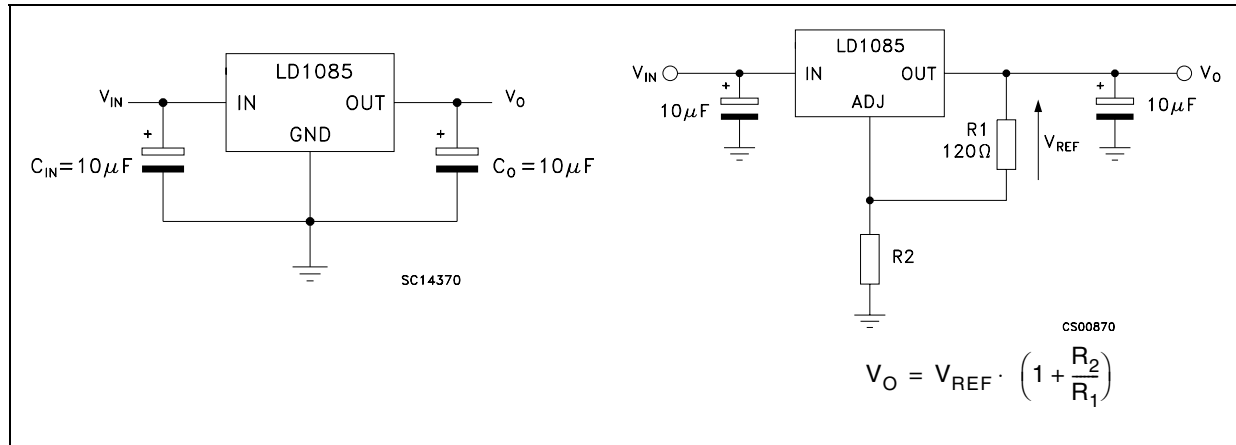
Note: Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied

Table 2. Thermal Data

Symbol	Parameter	TO-220	DPAK	D ² PAK D ² PAK/A	Unit
R_{thJC}	Thermal resistance junction-case	3	8	3	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	100	62.5	°C/W

3 Schematic application

Figure 2. Application circuit



4 Electrical characteristics

Table 3. Electrical characteristics of LD1085#15
($V_I=4.5V$, $C_I = C_O = 10\mu F$, $T_A = -40$ to $125^\circ C$, unless otherwise specified).

Symbol	Parameter	Test	Min.	Typ.	Max.	Unit
V_O	Output voltage ⁽¹⁾	$I_O = 0$ mA, $T_J = 25^\circ C$	1.485	1.5	1.515	V
		$I_O = 0$ to 3A, $V_I = 3.1$ to 30V	1.47	1.5	1.53	V
ΔV_O	Line Regulation	$I_O = 0$ mA, $V_I = 3.1$ to 18V, $T_J = 25^\circ C$		0.2	4	mV
		$I_O = 0$ mA, $V_I = 3.1$ to 15V		0.4	4	mV
ΔV_O	Load Regulation	$I_O = 0$ to 3A, $T_J = 25^\circ C$		2	10	mV
		$I_O = 0$ to 3A		4	20	mV
V_d	Dropout Voltage	$I_O = 3$ A		1.3	1.5	V
I_q	Quiescent Current	$V_I \leq 30V$		5	10	mA
I_{sc}	Short Circuit Current	$V_I - V_O = 5V$	3.2	4.5		A
		$V_I - V_O = 25V$	0.2	0.5		A
	Thermal Regulation	$T_A = 25^\circ C$, 30ms pulse		0.008	0.04	%/W
SVR	Supply Voltage Rejection	$f = 120$ Hz, $C_O = 25\mu F$, $I_O = 3A$ $V_I = 7.5 \pm 3V$	60	72		dB
eN	RMS Output Noise Voltage (% of V_O)	$T_A = 25^\circ C$, $f = 10Hz$ to 10KHz		0.003		%
S	Temperature Stability			0.5		%
S	Long Term Stability	$T_A = 125^\circ C$, 1000Hrs		0.5		%

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

Table 4. Electrical characteristics of LD1085#18(V_I=4.8V, C_I = C_O =10μF, T_A = -40 to 125°C, unless otherwise specified).

Symbol	Parameter	Test	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 3A, V _I = 3.4 to 30V	1.764	1.8	1.836	V
ΔV _O	Line Regulation	I _O = 0 mA, V _I = 3.4 to 18V T _J = 25°C		0.2	4	mV
		I _O = 0 mA, V _I = 3.4 to 15V		0.4	4	mV
ΔV _O	Load Regulation	I _O = 0 to 3A, T _J = 25°C		2	10	mV
		I _O = 0 to 3A		4	20	mV
V _d	Dropout Voltage	I _O = 3 A		1.3	1.5	V
I _q	Quiescent Current	V _I ≤30V		5	10	mA
I _{sc}	Short Circuit Current	V _I - V _O = 5V	3.2	4.5		A
		V _I - V _O = 25V	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 = 3A V _I = 7.5 ± 3V	60	72		dB
eN	RMS Output Noise Voltage (% of V _O)	T _A = 25°C, f =10Hz to 10KHz		0.003		%
S	Temperature Stability			0.5		%
S	Long Term Stability	T _A = 125°C, 1000Hrs		0.5		%

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

Table 5. Electrical characteristics of LD1085#25(V_I=5.5V, C_I = C_O =10μF, T_A = -40 to 125°C, unless otherwise specified).

Symbol	Parameter	Test	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 3A, V _I = 4.1 to 30V	2.45	2.5	2.55	V
ΔV _O	Line regulation	I _O = 0 mA, V _I = 4.1 to 18V, T _J = 25°C		0.2	4	mV
		I _O = 0 mA, V _I = 4.1 to 18V		0.4	4	mV
ΔV _O	Load regulation	I _O = 0 to 3A, T _J = 25°C		2	10	mV
		I _O = 0 to 3A		4	20	mV
V _d	Dropout voltage	I _O = 3A		1.3	1.5	V
I _q	Quiescent current	V _I ≤ 30V		5	10	mA
I _{sc}	Short circuit current	V _I - V _O = 5V	3.2	4.5		A
		V _I - V _O = 25V	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 = 3A V _I = 7.5 ± 3V	60	72		dB
eN	RMS Output noise voltage (% of V _O)	T _A = 25°C, f = 10Hz to 10KHz		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	T _A = 125°C, 1000Hrs		0.5		%

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

Table 6. Electrical characteristics of LD1085#33(V_I=6.3V, C_I = C_O =10μF, T_A = -40 to 125°C, unless otherwise specified).

Symbol	Parameter	Test	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 3A, V _I = 4.9 to 30V	3.234	3.35	3.366	V
ΔV _O	Line regulation	I _O = 0 mA, V _I = 4.9 to 18V, T _J = 25°C		0.5	6	mV
		I _O = 0 mA, V _I = 4.9 to 18V		1	6	mV
ΔV _O	Load regulation	I _O = 0 to 3A, T _J = 25°C		3	15	mV
		I _O = 0 to 3A		7	20	mV
V _d	Dropout voltage	I _O = 3A		1.3	1.5	V
I _q	Quiescent current	V _I ≤ 30V		5	10	mA
I _{sc}	Short circuit current	V _I - V _O = 5V	3.2	4.5		A
		V _I - V _O = 25V	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 = 3A V _I = 8.3 ± 3V	60	72		dB
eN	RMS Output noise voltage (% of V _O)	T _A = 25°C, f = 10Hz to 10KHz		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	T _A = 125°C, 1000Hrs		0.5		%

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

Table 7. Electrical characteristics of LD1085#50(V_I=8V, C_I = C_O =10μF, T_A = -40 to 125°C, unless otherwise specified).

Symbol	Parameter	Test	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 3A, V _I = 6.6 to 30V	4.9	5	5.1	V
ΔV _O	Line regulation	I _O = 0 mA, V _I = 6.6 to 20V, T _J = 25°C		0.5	10	mV
		I _O = 0 mA, V _I = 6.6 to 20V		1	10	mV
ΔV _O	Load regulation	I _O = 0 to 3A, T _J = 25°C		5	10	mV
		I _O = 0 to 3A		10	35	mV
V _d	Dropout voltage	I _O = 3A		1.3	1.5	V
I _q	Quiescent current	V _I ≤ 30V		5	10	mA
I _{sc}	Short circuit current	V _I - V _O = 5V	3.2	4.5		A
		V _I - V _O = 25V	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 = 3A V _I = 10 ± 3V	60	72		dB
eN	RMS Output noise voltage (% of V _O)	T _A = 25°C, f = 10Hz to 10KHz		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	T _A = 125°C, 1000Hrs		0.5		%

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

Table 8. Electrical characteristics of LD1085#12
($V_I=15V$, $C_I = C_O = 10\mu F$, $T_A = -40$ to $125^\circ C$, unless otherwise specified).

Symbol	Parameter	Test	Min.	Typ.	Max.	Unit
V_O	Output voltage ⁽¹⁾	$I_O = 0$ mA, $T_J = 25^\circ C$	11.88	12	12.12	V
		$I_O = 0$ to 3A, $V_I = 13.8$ to 30V	11.76	12	12.24	V
ΔV_O	Line regulation	$I_O = 0$ mA, $V_I = 13.8$ to 25V, $T_J = 25^\circ C$		1	25	mV
		$I_O = 0$ mA, $V_I = 13.8$ to 25V		2	25	mV
ΔV_O	Load regulation	$I_O = 0$ to 3A, $T_J = 25^\circ C$		12	36	mV
		$I_O = 0$ to 3A		24	72	mV
V_d	Dropout voltage	$I_O = 3$ A		1.3	1.5	V
I_q	Quiescent current	$V_I \leq 30V$		5	10	mA
I_{sc}	Short circuit current	$V_I - V_O = 5V$	3.2	4.5		A
		$V_I - V_O = 25V$	0.2	0.5		A
	Thermal regulation	$T_A = 25^\circ C$, 30ms pulse		0.008	0.04	%/W
SVR	Supply voltage rejection	$f = 120$ Hz, $C_O = 25\mu F$, $I_O = 3$ A $V_I = 17 \pm 3V$	54	66		dB
eN	RMS Output noise voltage (% of V_O)	$T_A = 25^\circ C$, $f = 10$ Hz to 10KHz		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	$T_A = 125^\circ C$, 1000Hrs		0.5		%

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

Table 9. Electrical characteristics of LD1085#
 ($V_I=4.25V$, $C_I = C_O = 10\mu F$, $T_A = -40$ to $125^\circ C$, unless otherwise specified).

Symbol	Parameter	Test	Min.	Typ.	Max.	Unit
V_O	Output voltage ⁽¹⁾	$I_O = 10mA$, $T_J = 25^\circ C$	1.237	1.25	1.263	V
		$I_O = 10mA$ to $3A$, $V_I = 2.85$ to $30V$	1.225	1.25	1.275	V
ΔV_O	Line Regulation	$I_O = 10mA$, $V_I = 2.85$ to $16.5V$, $T_J = 25^\circ C$		0.015	0.2	%
		$I_O = 10mA$, $V_I = 2.85$ to $16.5V$		0.035	0.2	%
ΔV_O	Load Regulation	$I_O = 10mA$ to $3A$, $T_J = 25^\circ C$		0.1	0.3	%
		$I_O = 0$ to $3A$		0.2	0.4	%
V_d	Dropout Voltage	$I_O = 3A$		1.3	1.5	V
$I_{O(min)}$	Minimum Load Current	$V_I = 30V$		3	10	mA
I_{sc}	Short Circuit Current	$V_I - V_O = 5V$	5.5	6.5		A
		$V_I - V_O = 25V$	0.5	0.7		A
	Thermal Regulation	$T_A = 25^\circ C$, 30ms pulse		0.003	0.015	%/W
SVR	Supply Voltage Rejection	$f = 120$ Hz, $C_O = 25\mu F$, $C_{ADJ} = 25\mu F$, $I_O = 3A$, $V_I = 6.25 \pm 3V$	60	72		dB
I_{ADJ}	Adjust Pin Current	$V_I = 4.25V$, $I_O = 10$ mA		55	120	μA
ΔI_{ADJ}	Adjust Pin Current Change ⁽¹⁾	$I_O = 10mA$ to $3A$, $V_I = 2.85$ to $16.5V$		0.2	5	μA
eN	RMS Output Noise Voltage (% of V_O)	$T_A = 25^\circ C$, $f = 10Hz$ to $10KHz$		0.003		%
S	Temperature Stability			0.5		%
S	Long Term Stability	$T_A = 125^\circ C$, 1000Hrs		0.5		%

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

5 Typical application

(Unless otherwise specified $T_J = 25^\circ\text{C}$, $C_I = C_O = 10\mu\text{F}$)

Figure 3. Output voltage vs temperature

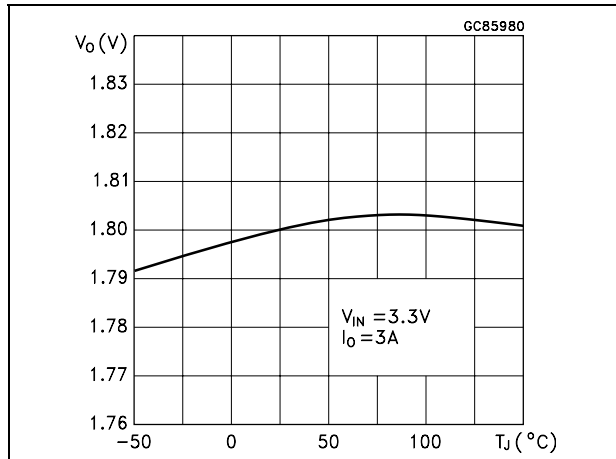


Figure 4. Output voltage vs temperature

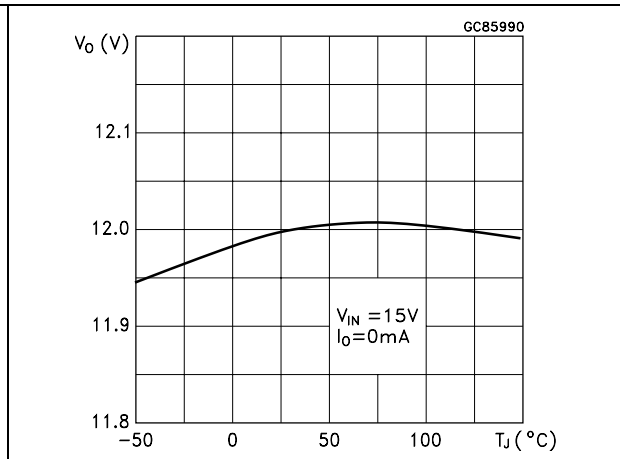


Figure 5. Output voltage vs temperature

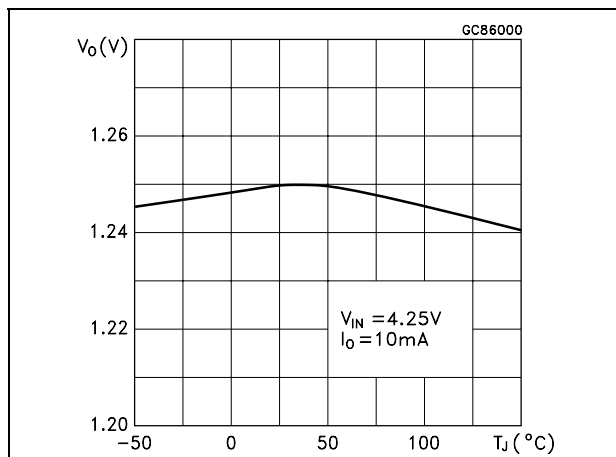


Figure 6. Short circuit current vs dropout voltage

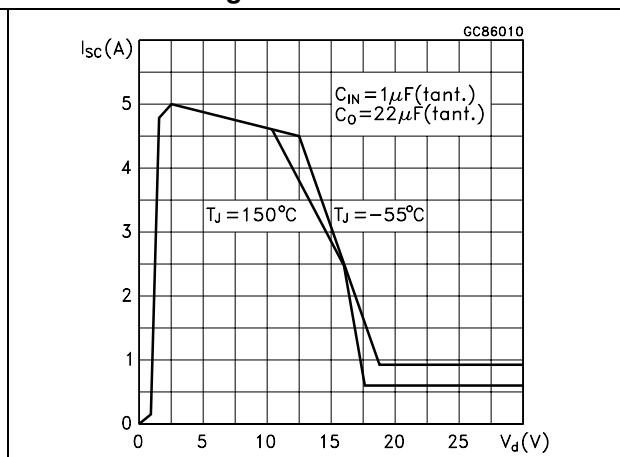


Figure 7. Line regulation vs temperature

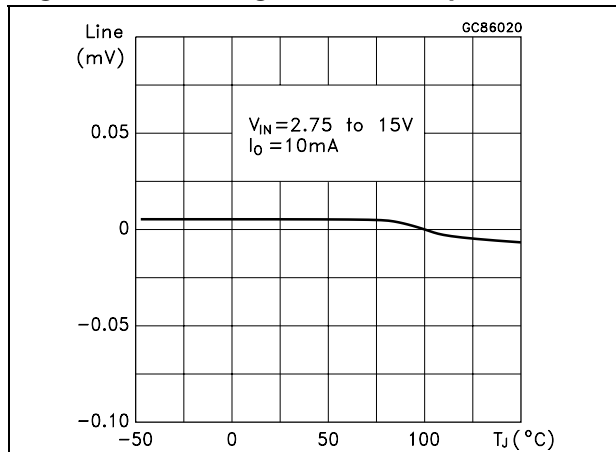


Figure 8. Load regulation vs temperature

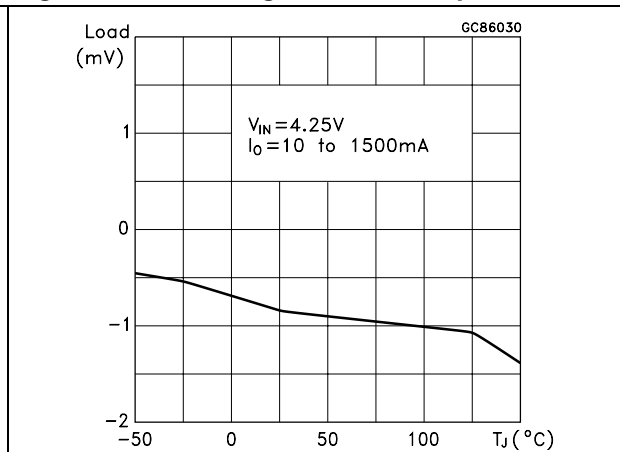


Figure 9. Dropout voltage vs temperature

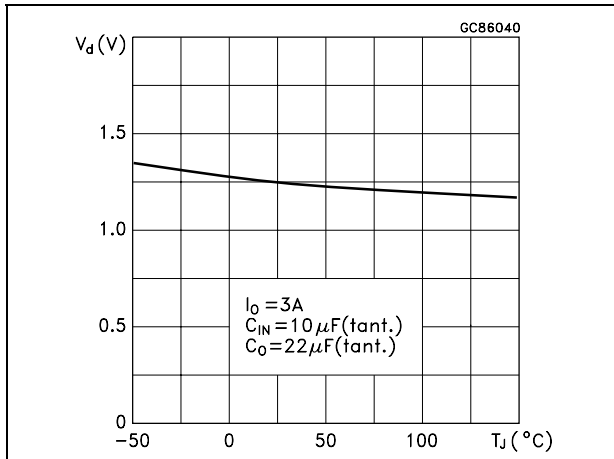


Figure 10. Dropout voltage vs output current

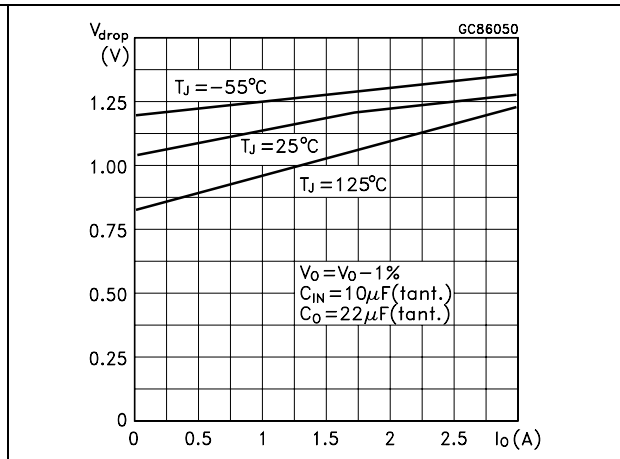


Figure 11. Adjust pin current vs temperature

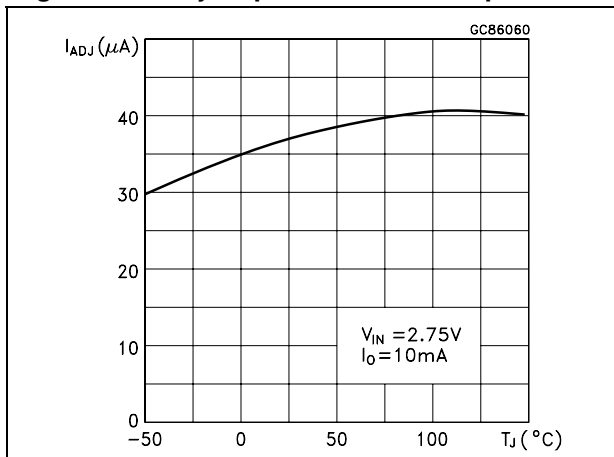


Figure 12. Quiescent current vs temperature

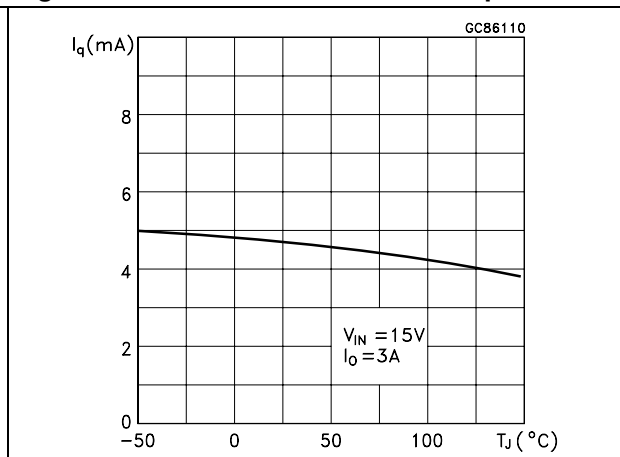


Figure 13. Line regulation vs temperature

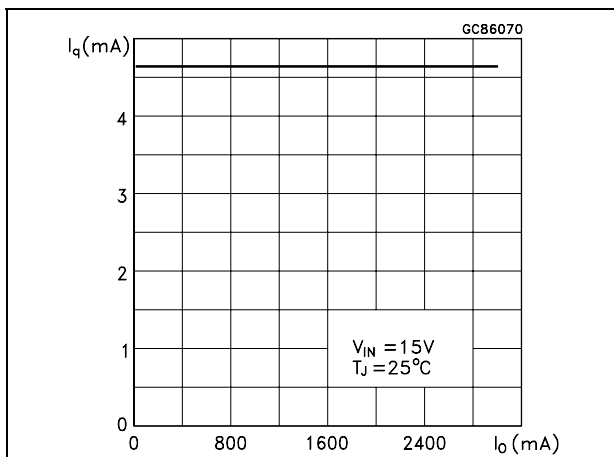


Figure 14. Supply voltage rejection vs output current

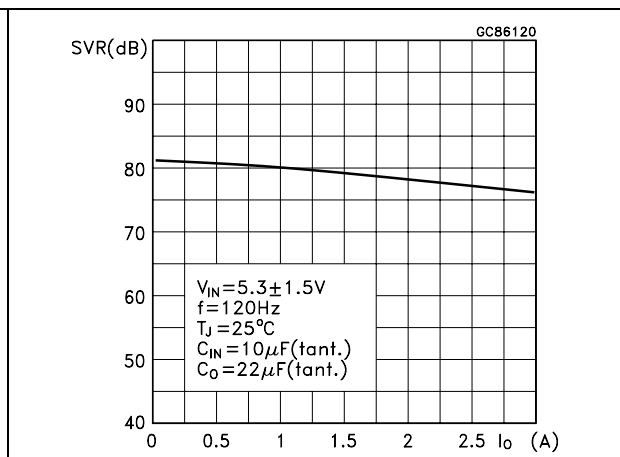


Figure 15. Supply voltage rejection vs frequency

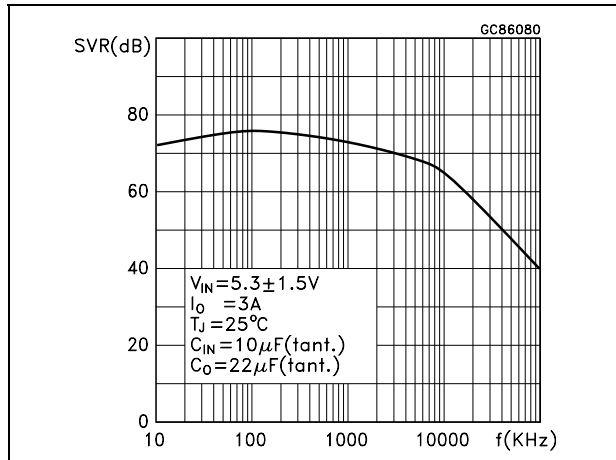


Figure 16. Supply voltage rejection vs temperature

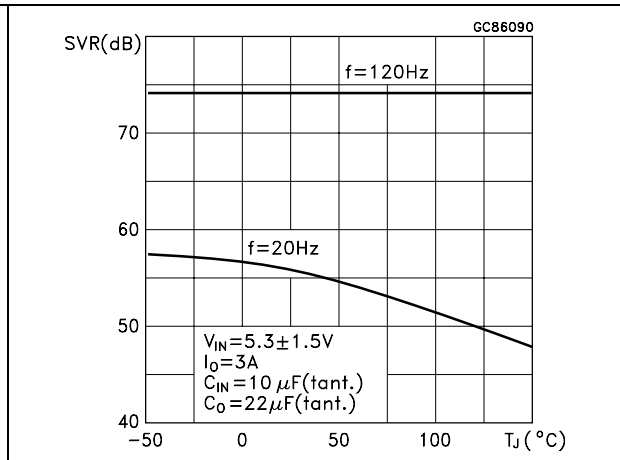


Figure 17. Minimum load current vs temperature

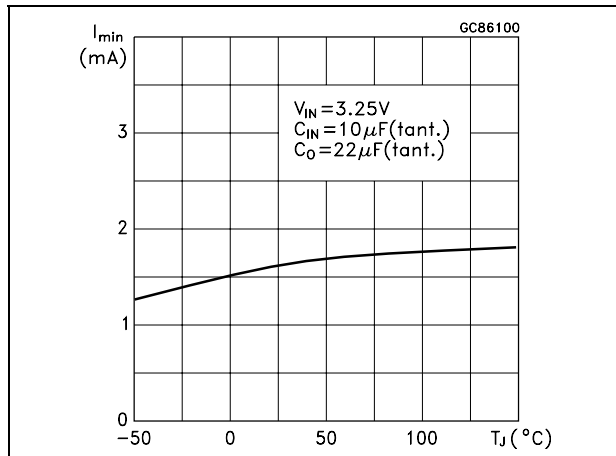


Figure 18. Stability

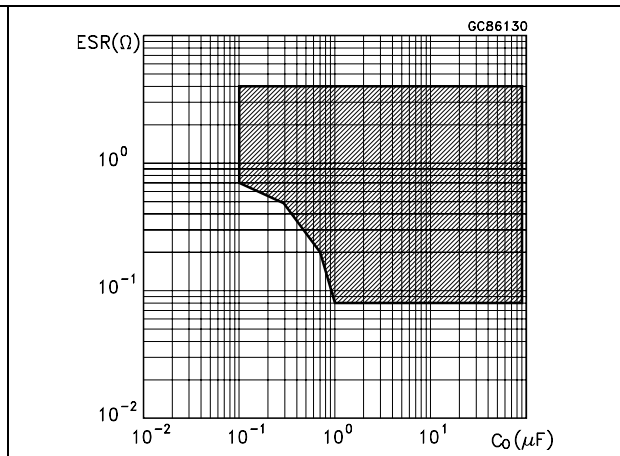


Figure 19. Stability

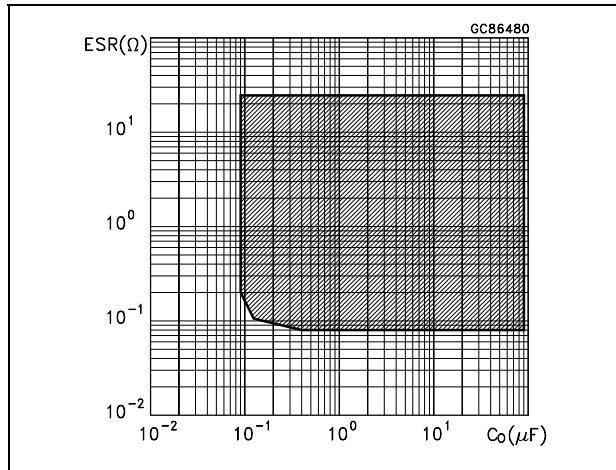


Figure 20. Line transient

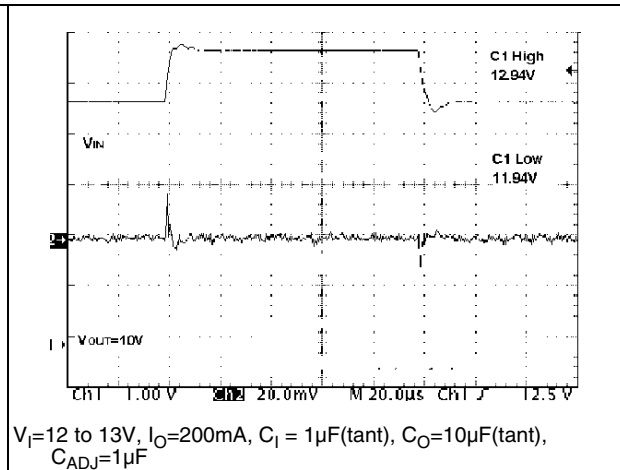
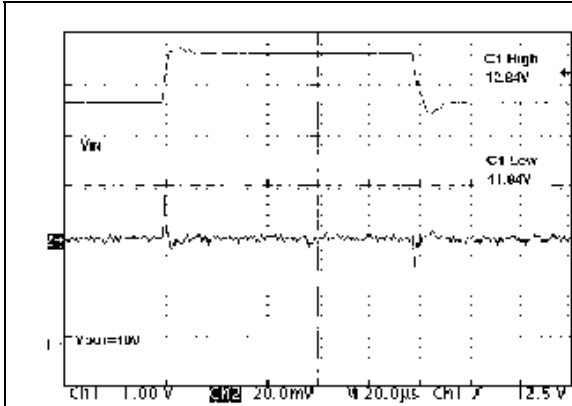
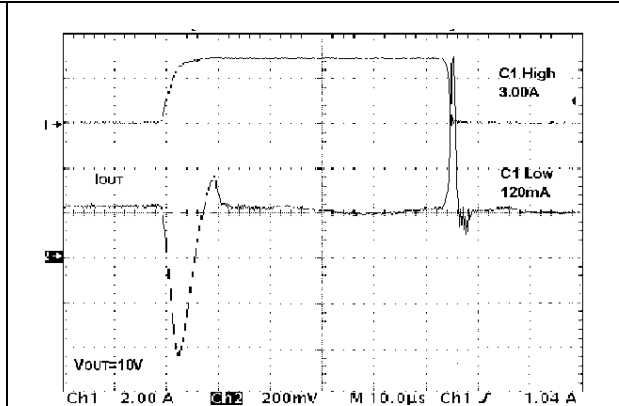


Figure 21. Line transient



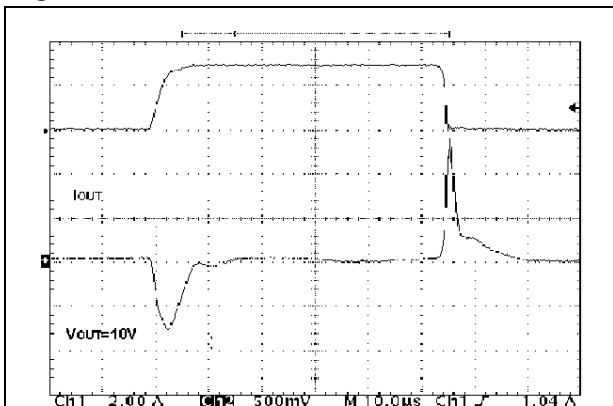
$V_I=12$ to $13V$, $I_O=200mA$, $C_1 = 1\mu F$ (tant), $C_O=10\mu F$ (tant), $C_{ADJ}=1\mu F$

Figure 22. Load transient



$V_I=12V$, $I_O=0.12$ to $3A$, $C_1 = 1\mu F$ (tant), $C_O=10\mu F$ (tant), $C_{ADJ}=1\mu F$

Figure 23. Load transient



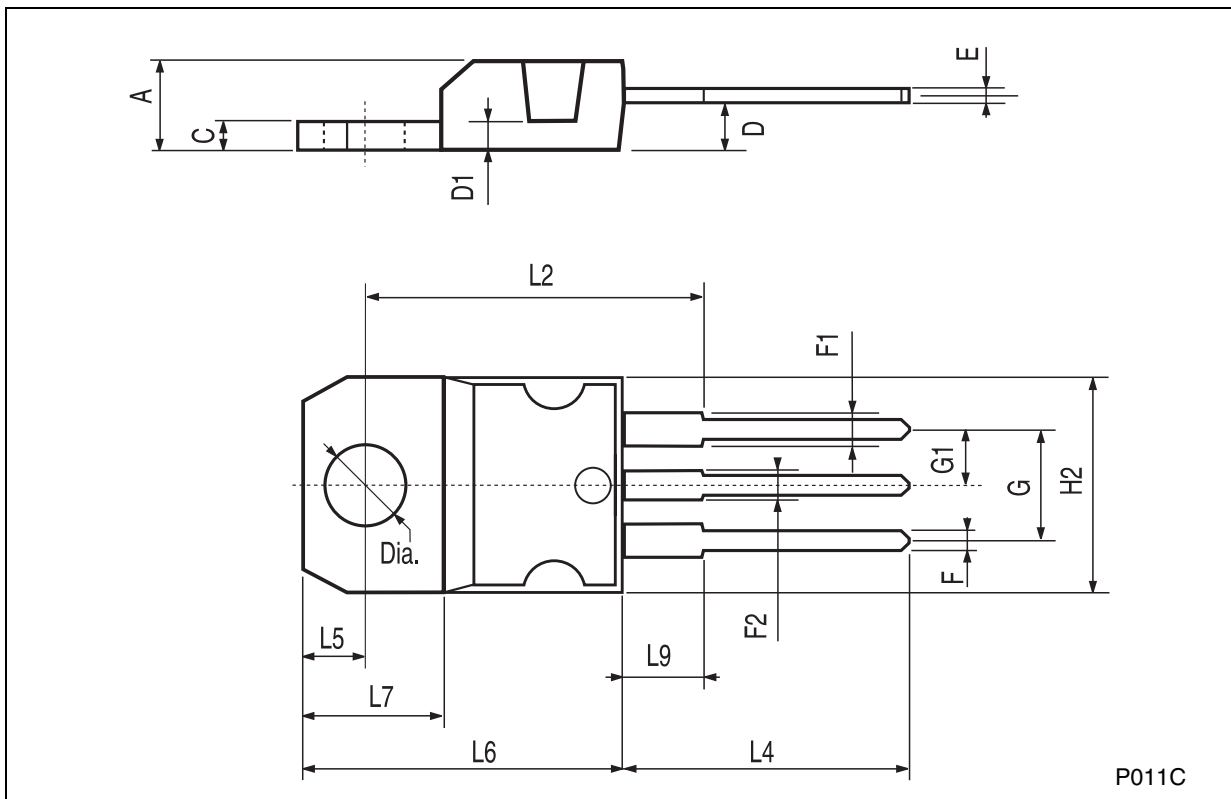
$V_I=12V$, $I_O=0.12$ to $3A$, $C_1 = 1\mu F$ (tant), $C_O=10\mu F$ (tant), $C_{ADJ}=1\mu F$

6 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.

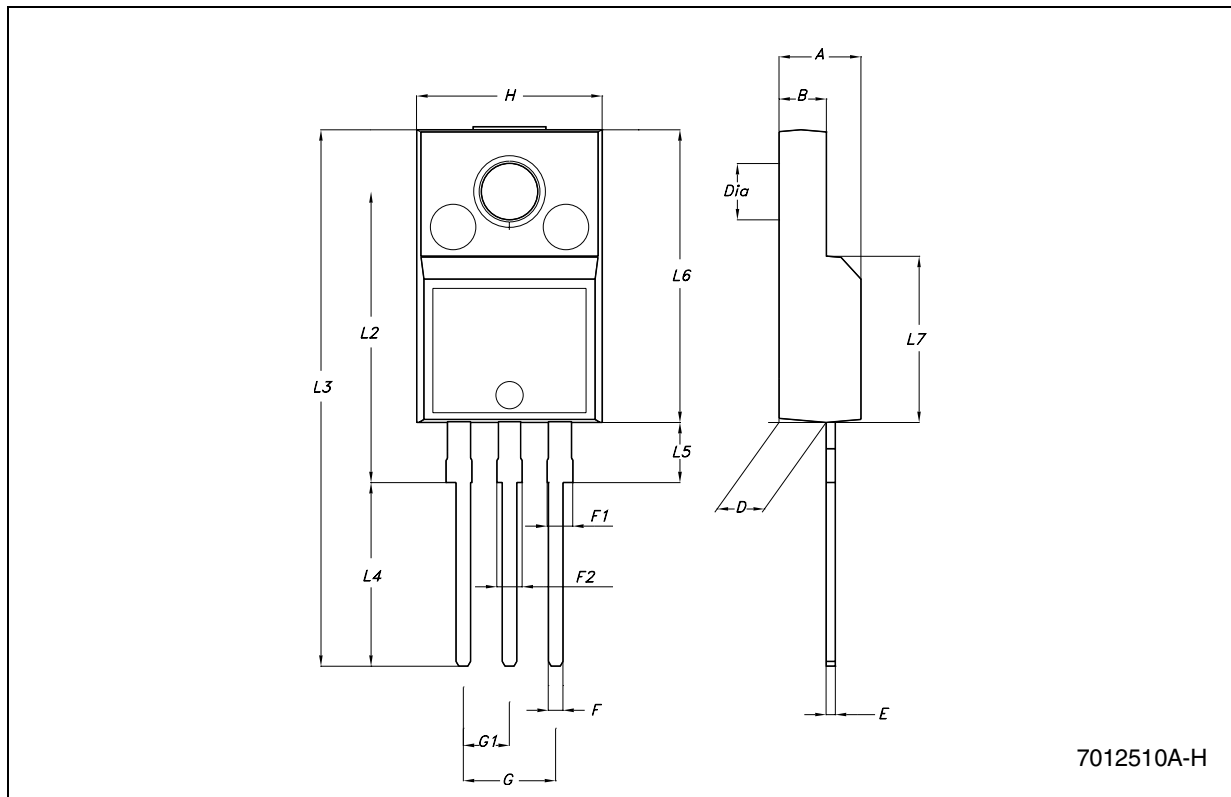
TO-220 MECHANICAL DATA

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



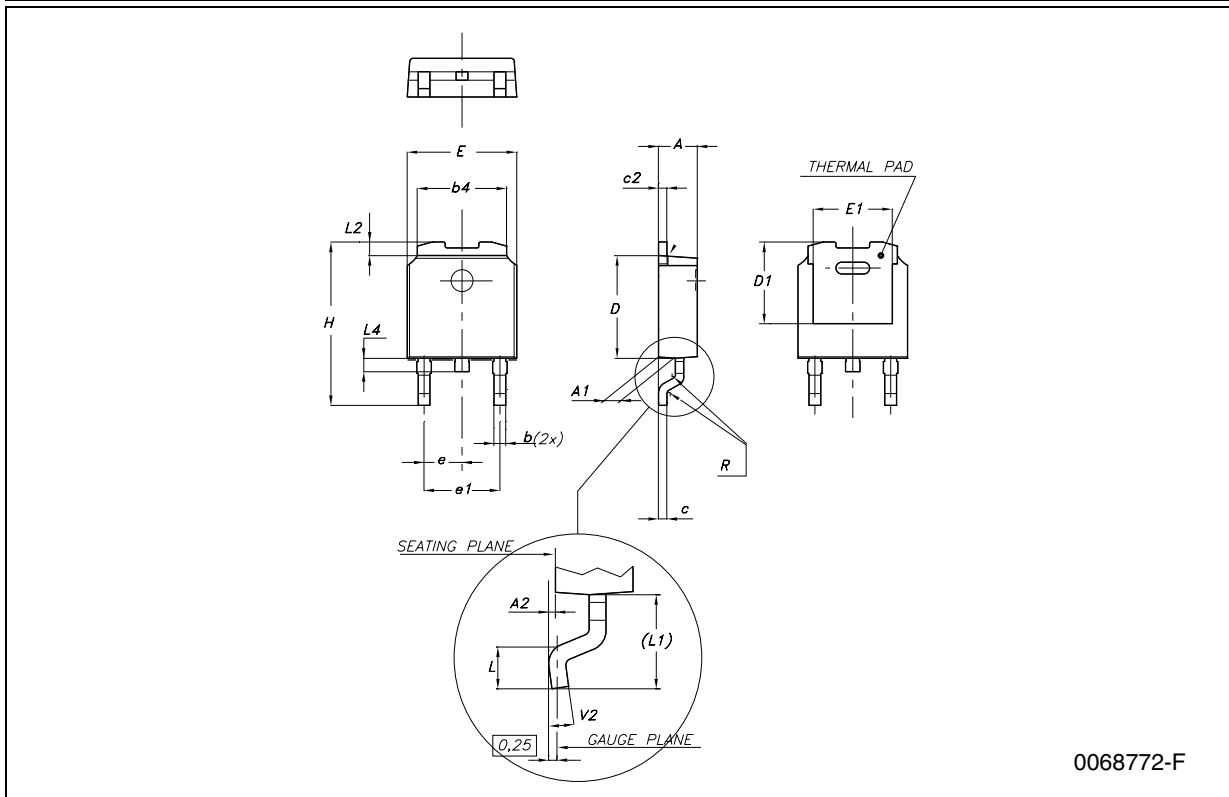
TO-220FP MECHANICAL DATA

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



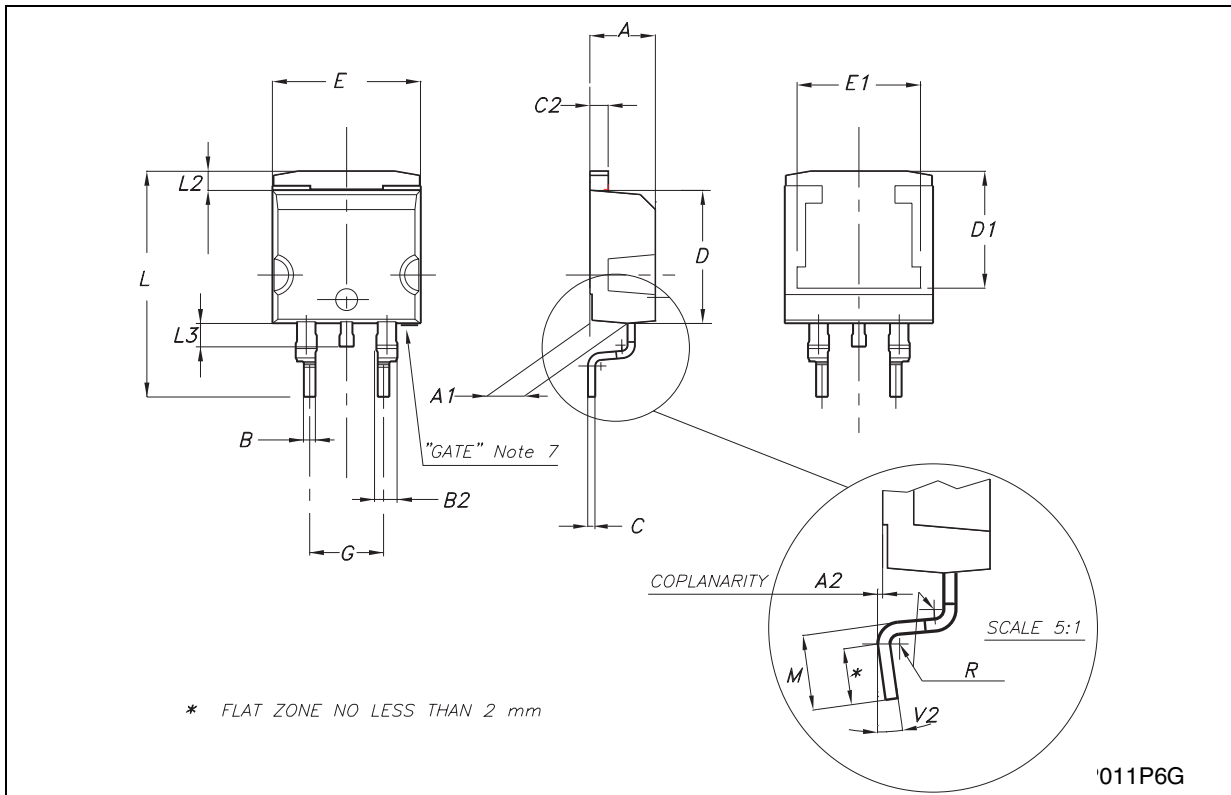
DPAK MECHANICAL DATA

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°



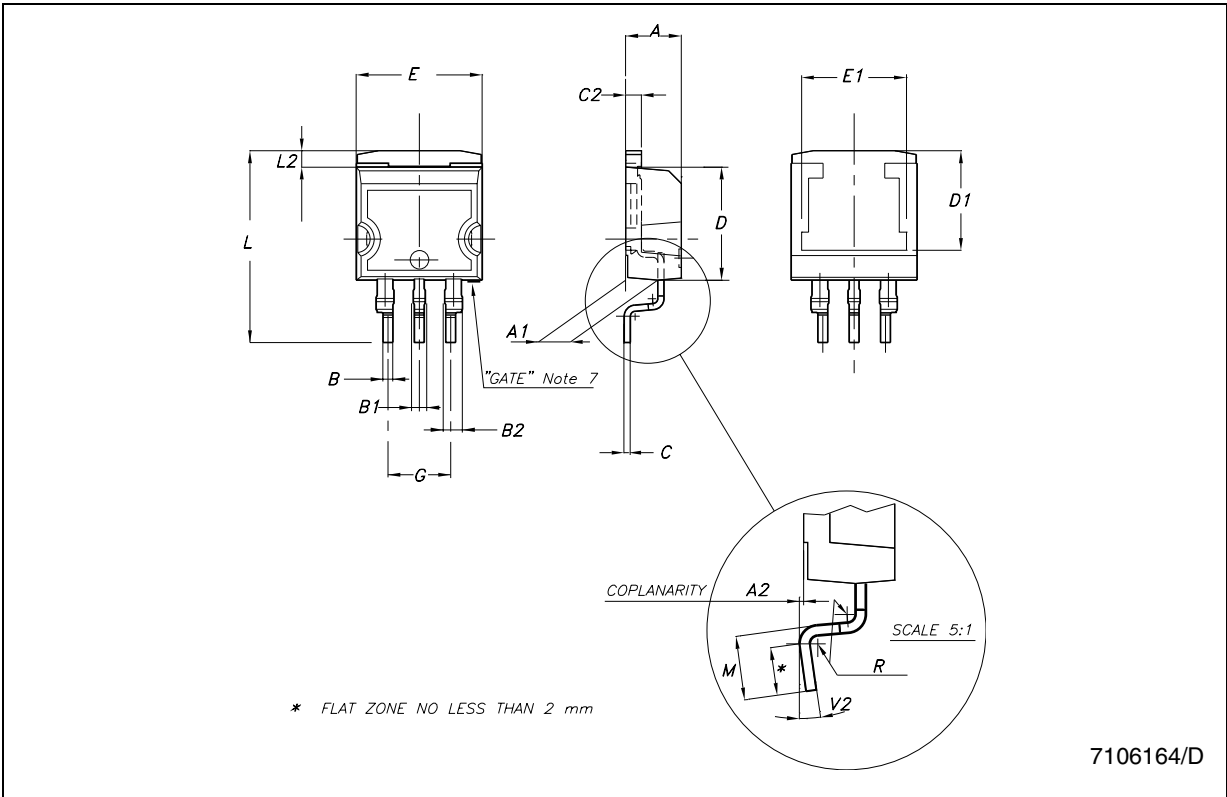
D²PAK MECHANICAL DATA

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°



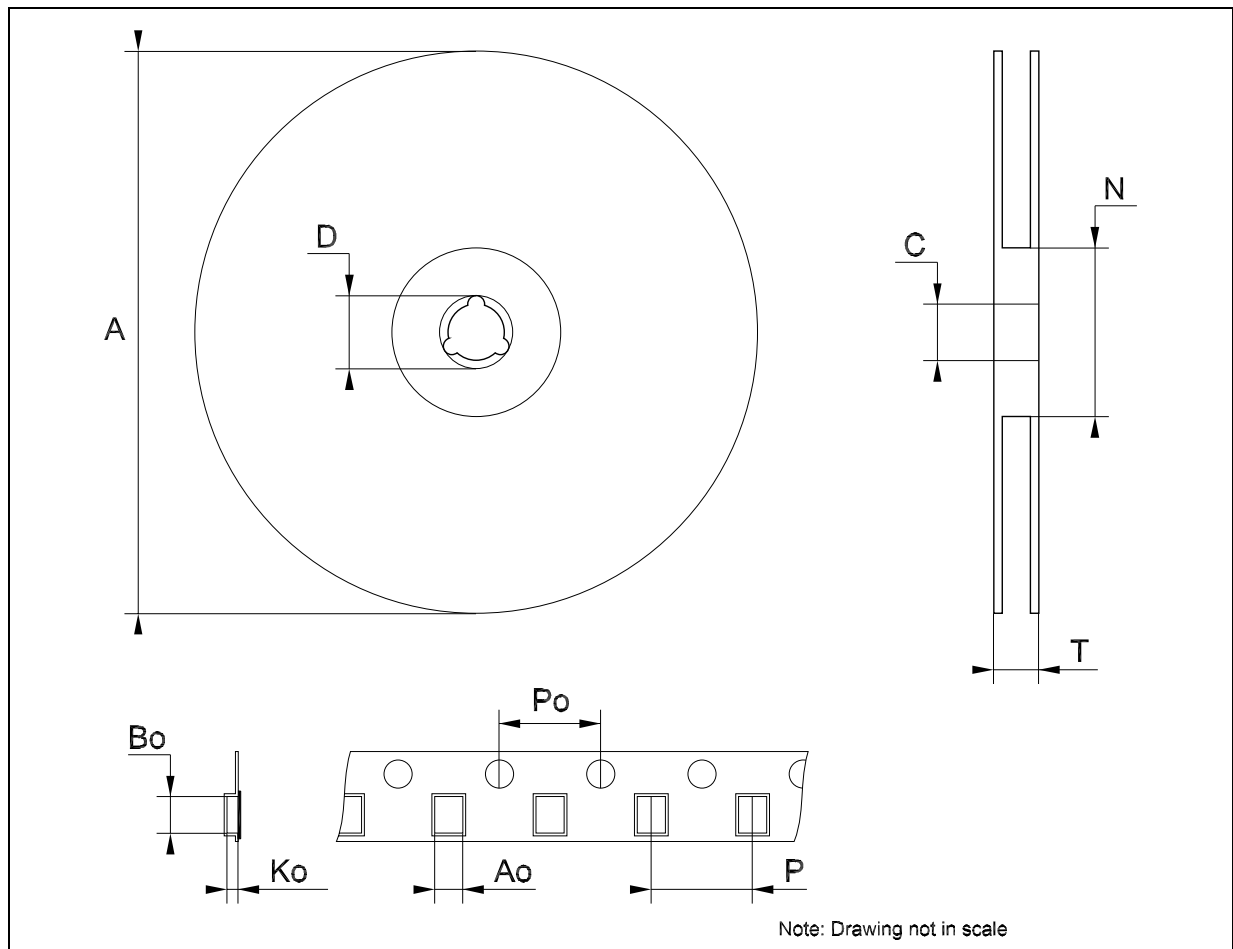
D²PAK/A MECHANICAL DATA

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°



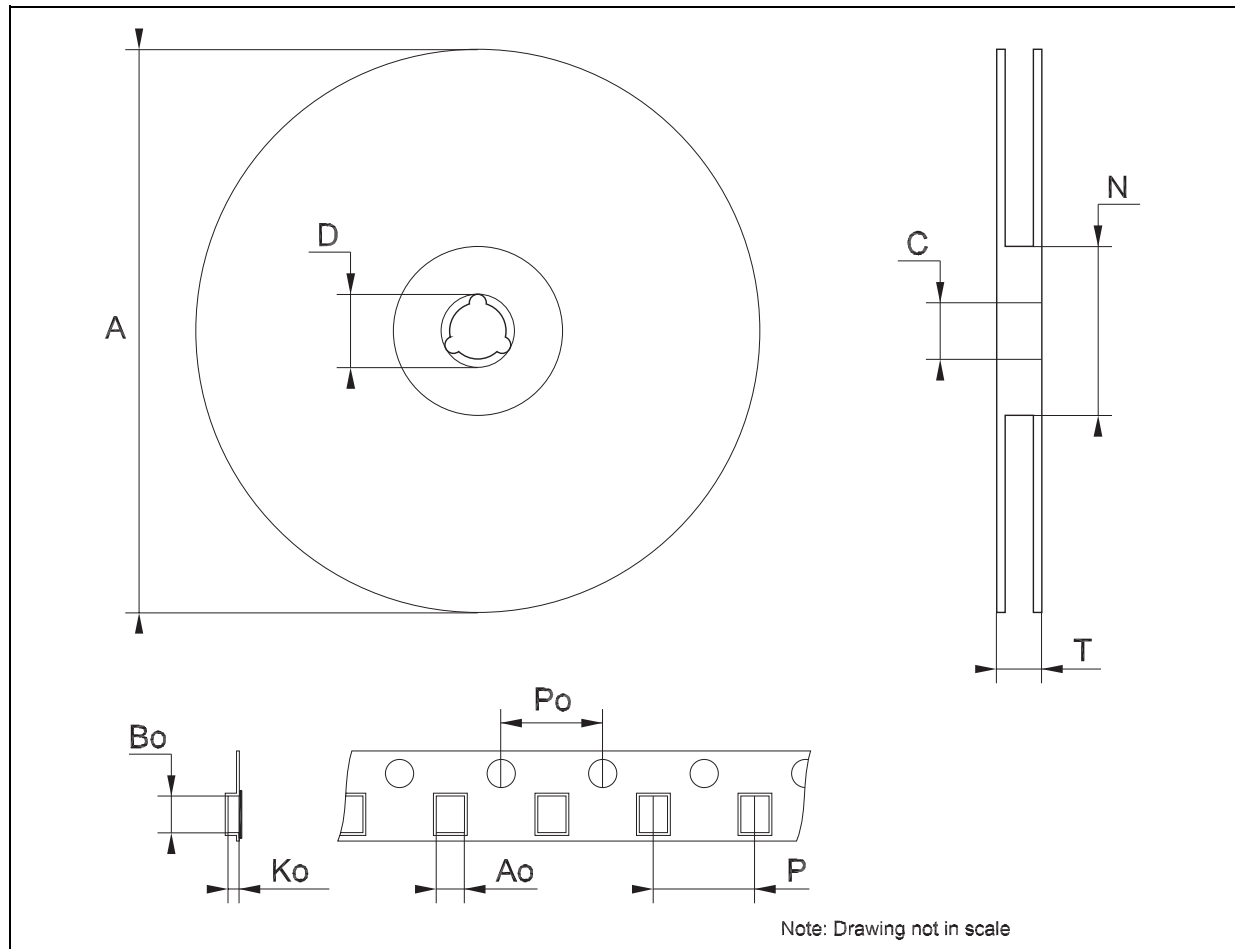
Tape & Reel DPAK-PPAK MECHANICAL DATA

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	0.276
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 D²PAK-P²PAK-D²PAK/A-P²PAK/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



7 Order codes

Table 10. Order codes

Part numbers						
Packages						Output voltage
TO-220	TO-220FP	D ² PAK	DPAK (T&R)	D ² PAK/A	D ² PAK/A (T&R)	
			LD1085DT15R			1.5 V
LD1085V18			LD1085DT18R		LD1085D2M18R	1.8 V
LD1085V25			LD1085DT25R		LD1085D2M25R	2.5 V
LD1085V33		LD1085D2T33	LD1085DT33R		LD1085D2M33R	3.3 V
LD1085V50				LD1085D2M50		5.0 V
LD1085V12				LD1085D2M12	LD1085D2M12R	12.0 V
LD1085V	LD1085P	LD1085D2T	LD1085DT-R	LD1085D2M	LD1085D2M-R	ADJ
			LD1085CDT-R			ADJ

8 Revision history

Table 11. 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 1.2V 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 has been updated.
07-Jun-2007	18	Order codes has been updated.

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