

5 A low drop positive voltage regulator adjustable and fixed

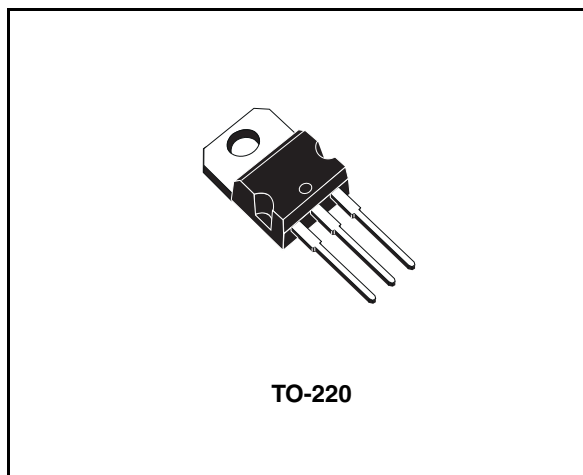
Features

- Typical dropout 1.3 V (at 5 A)
- Three terminal adjustable or fixed output voltage 2.5 V, 5 V, 12 V.
- Guaranteed output current up to 5 A
- 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
- Pinout compatibility with standard adjustable VREG

Description

The LD1084xx is a low drop voltage regulator able to provide up to 5 A of output current. Dropout is guaranteed at a maximum of 1.5 V at the maximum output current, decreasing at lower loads. The LD1084xx is pin to pin compatible with the older 3-terminal adjustable regulators, but has better performances in term 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 LD1084xx 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. On chip trimming allows the regulator to reach a very tight output voltage tolerance, within $\pm 1\%$ at 25 °C.

Table 1. Device summary

Part numbers	Order codes	Output voltage
LD1084XX12	LD1084V12	12 V
LD1084XX25	LD1084V25	2.5 V
LD1084XX50	LD1084V50	5.0 V
LD1084XX	LD1084V	Adjustable

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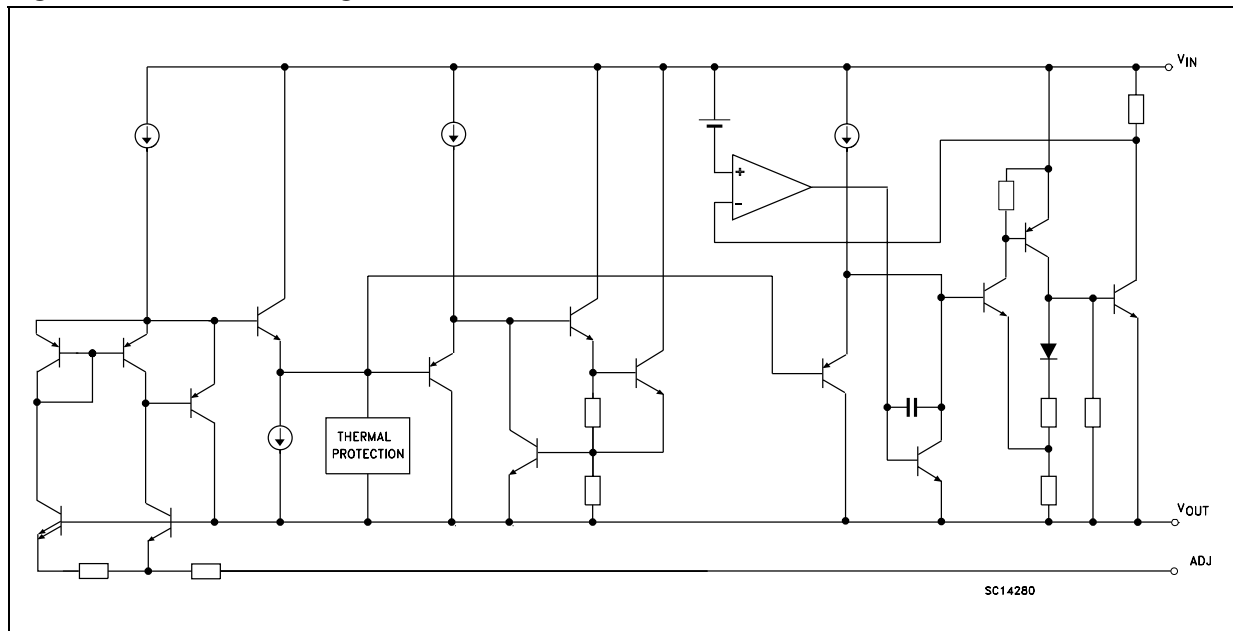
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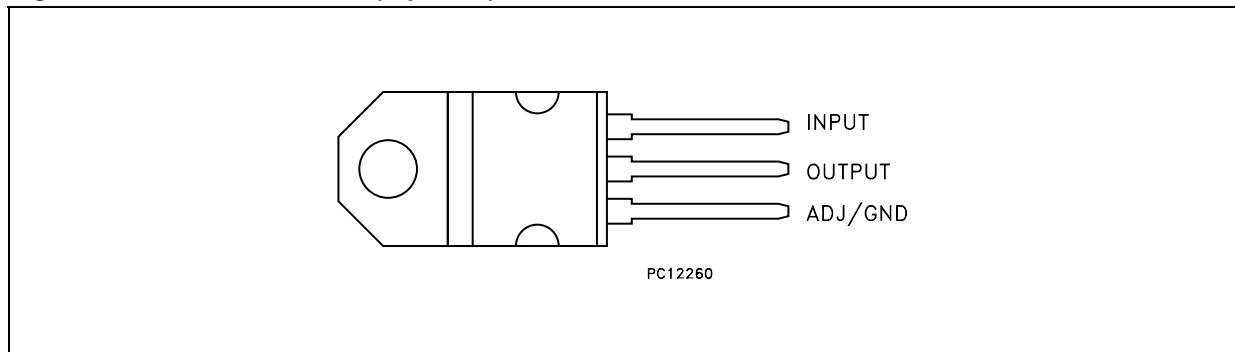
1 Diagram

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

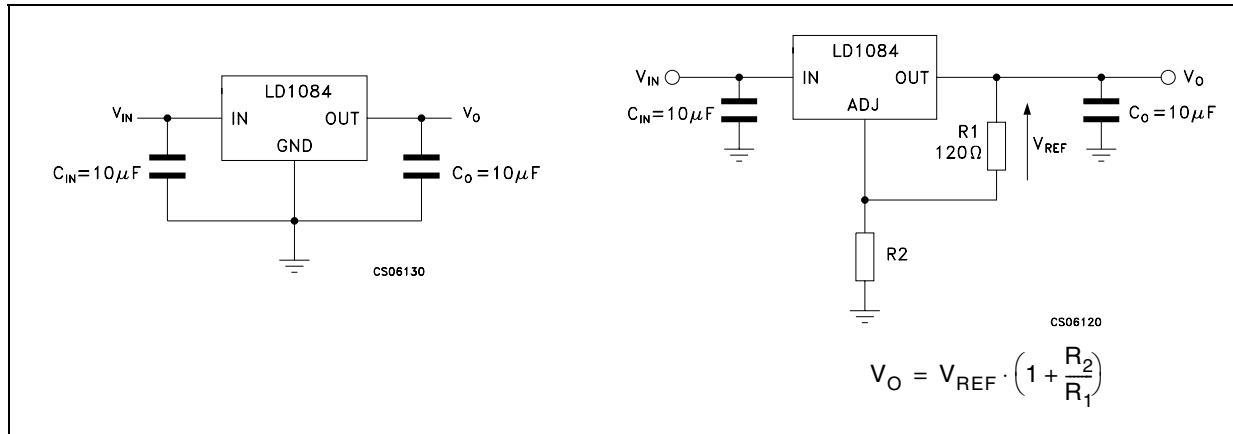
Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied

Table 3. Thermal data

Symbol	Parameter	TO-220	Unit
R_{thJC}	Thermal resistance junction-case	3	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	°C/W

4 Schematic application

Figure 3. Application circuit



5 Electrical characteristics

Table 4. Electrical characteristics of LD1084#25

($V_I = 5.5\text{ V}$, $C_I = C_O = 10\text{ }\mu\text{F}$, $T_A = -40\text{ to }125\text{ }^\circ\text{C}$, unless otherwise specified).

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_O	Output voltage ⁽¹⁾	$I_O = 0\text{ mA}$, $T_J = 25^\circ\text{C}$	2.475	2.5	2.525	V
		$I_O = 0\text{ to }5\text{ A}$, $V_I = 4.1\text{ to }30\text{ V}$	2.45	2.5	2.55	V
ΔV_O	Line regulation	$I_O = 0\text{ mA}$, $V_I = 4.1\text{ to }18\text{ V}$, $T_J = 25^\circ\text{C}$		0.5	6	mV
		$I_O = 0\text{ mA}$, $V_I = 4.1\text{ to }18\text{ V}$		0.1	6	mV
ΔV_O	Load regulation	$I_O = 0\text{ to }5\text{ A}$, $T_J = 25^\circ\text{C}$		3	15	mV
		$I_O = 0\text{ to }5\text{ A}$		7	20	mV
V_d	Dropout voltage	$I_O = 5\text{ A}$		1.3	1.5	V
I_q	Quiescent current	$V_I \leq 30\text{ V}$		5	10	mA
I_{sc}	Short circuit current	$V_I - V_O = 5\text{ V}$	5.5	6.5		A
		$V_I - V_O = 25\text{ V}$	0.5	0.7		A
	Thermal regulation	$T_A = 25^\circ\text{C}$, 30ms pulse		0.003	0.015	%/W
SVR	Supply voltage rejection	$f = 120\text{ Hz}$, $C_O = 25\text{ }\mu\text{F}$, $I_O = 5\text{ A}$ $V_I = 7.5 \pm 3\text{ V}$	60	72		dB
eN	RMS output noise voltage (% of V_O)	$T_A = 25^\circ\text{C}$, $f = 10\text{ Hz to }10\text{ kHz}$		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	$T_A = 125^\circ\text{C}$, 1000Hrs		0.5		%

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

Table 5. Electrical characteristics of LD1084#50(V_I = 8 V, C_I = C_O = 10 µF, T_A = -40 to 125 °C, unless otherwise specified).

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 5A, 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 5A, T _J = 25°C		5	20	mV
		I _O = 0 to 5A		10	35	mV
V _d	Dropout voltage	I _O = 5A		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	5.5	6.5		A
		V _I - V _O = 25V	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 = 25µF, I _O = 5A 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 6. Electrical characteristics of LD1084#12(V_I = 15 V, C_I = C_O = 10 µF, T_A = -40 to 125 °C, unless otherwise specified).

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V _O	Output voltage ⁽¹⁾	I _O = 0 mA, T _J = 25°C	11.88	12	12.12	V
		I _O = 0 to 5A, V _I = 13.6 to 30V	11.76	12	12.24	V
ΔV _O	Line regulation	I _O = 0 mA, V _I = 13.6 to 25V, T _J = 25°C		2	25	mV
		I _O = 0 mA, V _I = 13.6 to 25V		4	25	mV
ΔV _O	Load regulation	I _O = 0 to 5A, T _J = 25°C		12	36	mV
		I _O = 0 to 5A		24	72	mV
V _d	Dropout voltage	I _O = 5A		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	5.5	6.5		A
		V _I - V _O = 25V	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 = 25µF, I _O = 5A V _I = 17 ± 3V	54	66		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 LD1084(V_I = 4.25 V, C_I = C_O = 10 µF, T_A = -40 to 125 °C, unless otherwise specified).

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V _O	Output voltage ⁽¹⁾	I _O = 10mA T _J = 25°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°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 5A, T _J = 25°C		0.1	0.3	%
		I _O = 0 to 5A		0.2	0.4	%
V _d	Dropout voltage	I _O = 5A		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°C, 30ms pulse		0.003	0.015	%/W
SVR	Supply voltage rejection	f = 120 Hz, C _O = 25µF, C _{ADJ} = 25 µF, I _O = 5A, V _I = 6.25 ± 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 5A, V _I = 2.85 to 16.5V		0.2	5	µA
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.

6 Typical application

Unless otherwise specified $T_J = 25^\circ\text{C}$, $C_I = 10\mu\text{F}$ (tant.), $C_O = 22\mu\text{F}$ (tant.)

Figure 4. Short circuit current vs dropout voltage

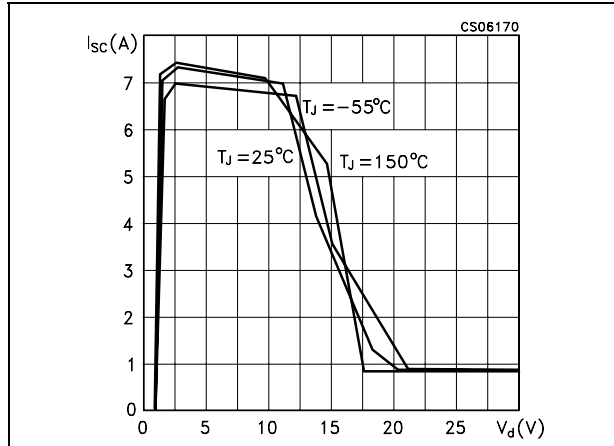


Figure 5. Line regulation vs temperature

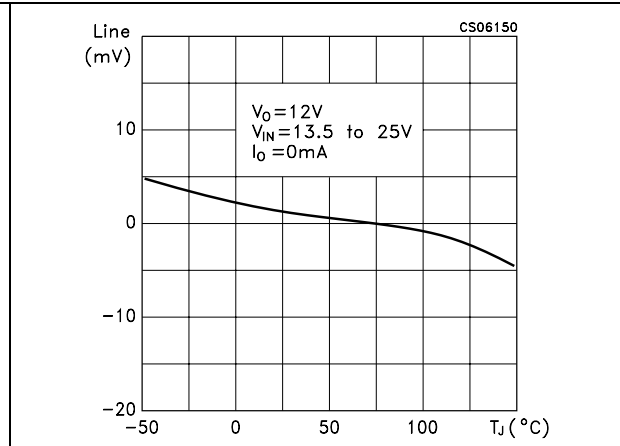


Figure 6. Quiescent current vs temperature

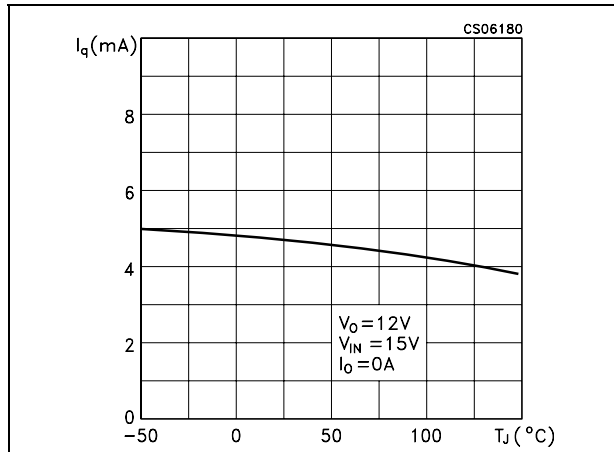


Figure 7. Output voltage vs temperature

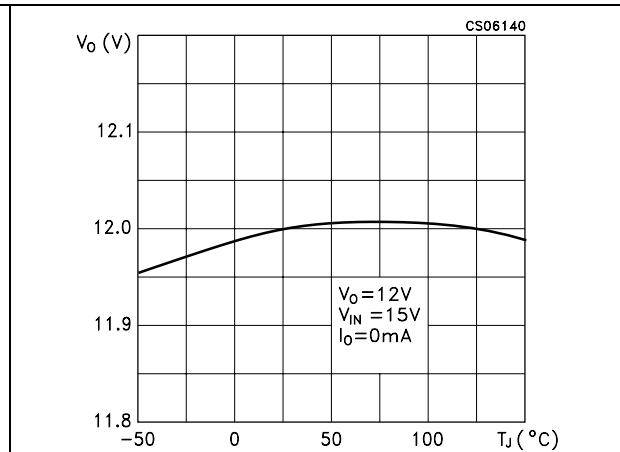


Figure 8. Load regulation vs temperature

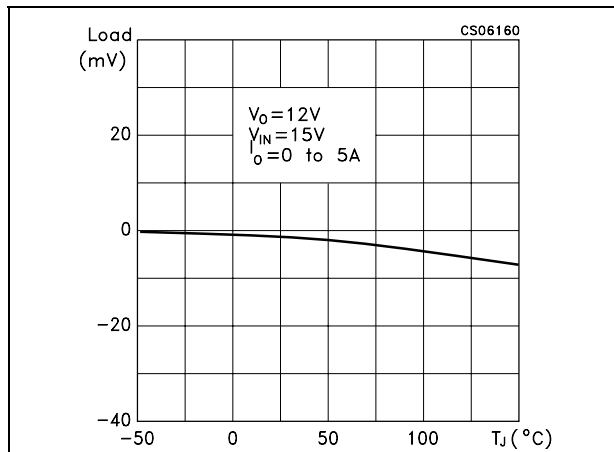


Figure 9. Quiescent current vs output voltage

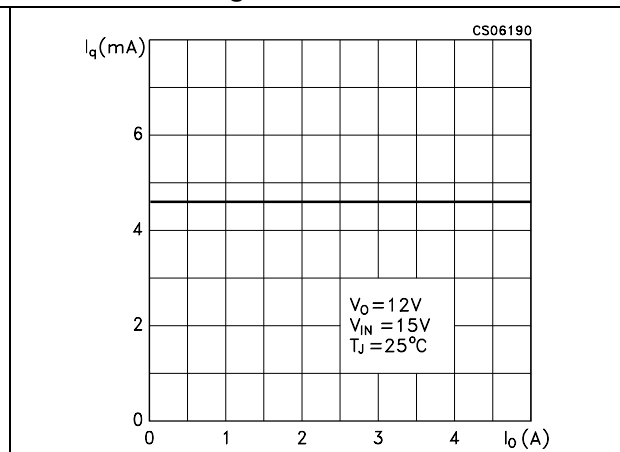


Figure 10. Quiescent current vs input voltage

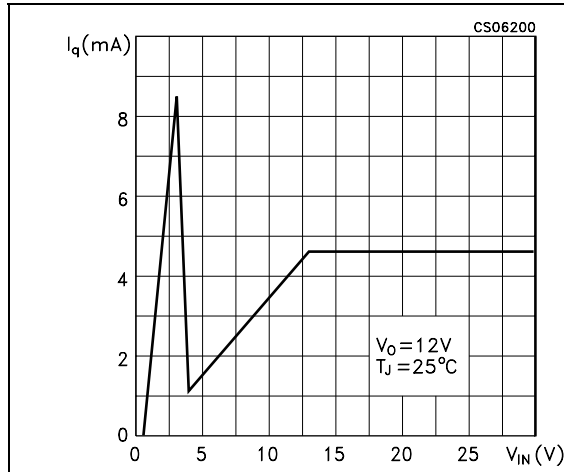


Figure 11. Dropout voltage vs output current

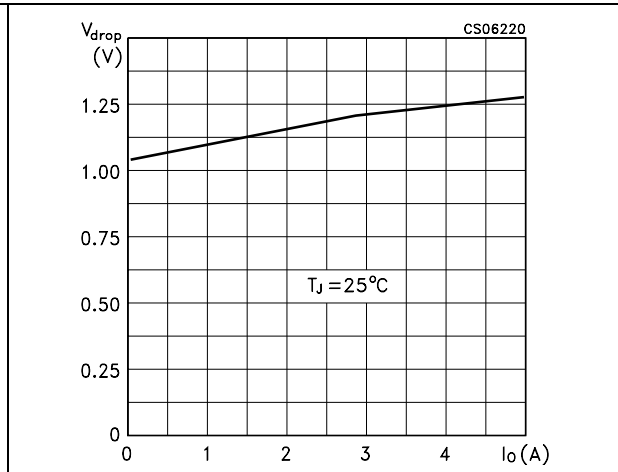


Figure 12. Supply voltage rejection vs output current

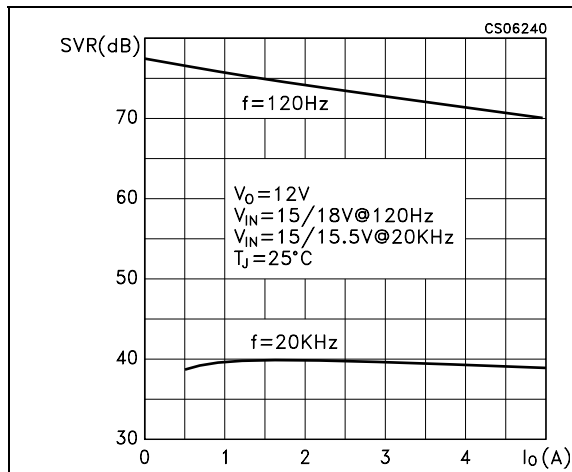


Figure 13. Dropout voltage vs temperature

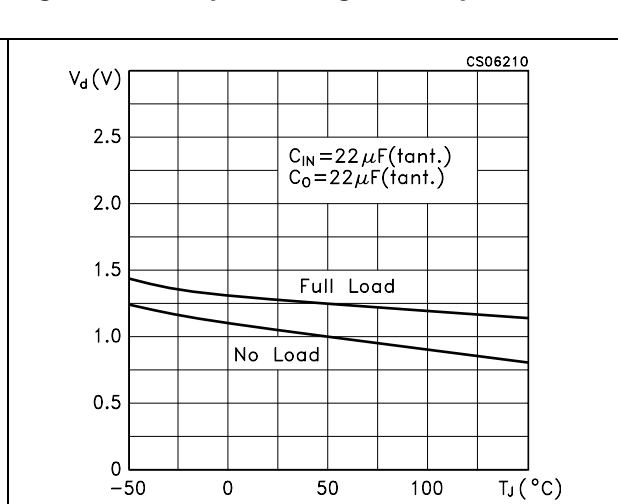


Figure 14. Supply voltage rejection vs temperature

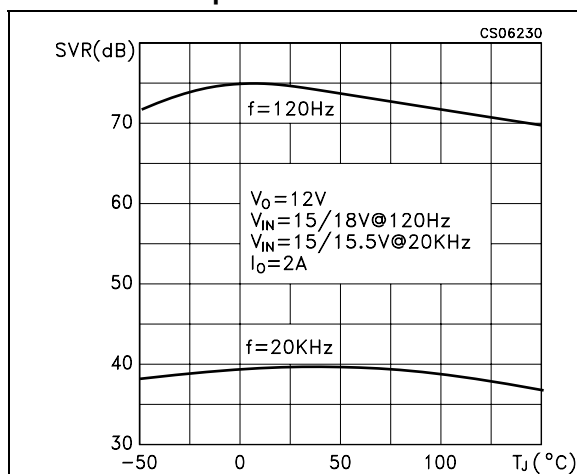


Figure 15. Supply voltage rejection vs frequency

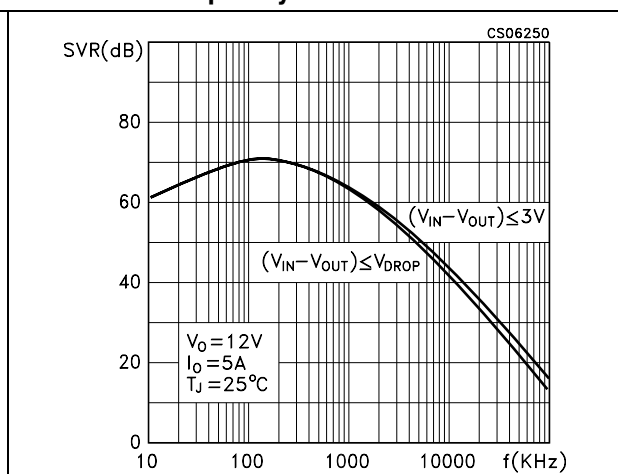


Figure 16. Adjust pin current vs output current

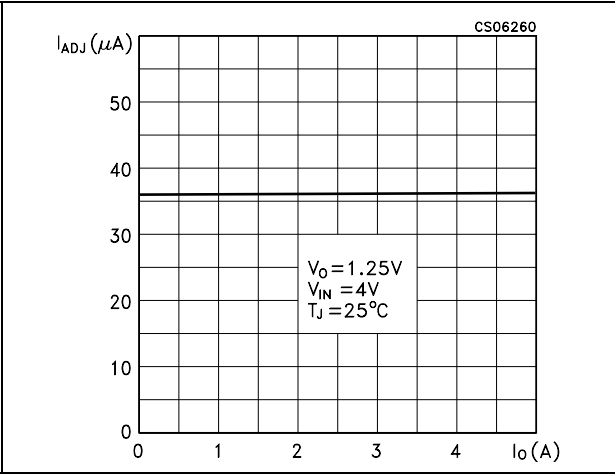


Figure 17. Reference voltage vs temperature

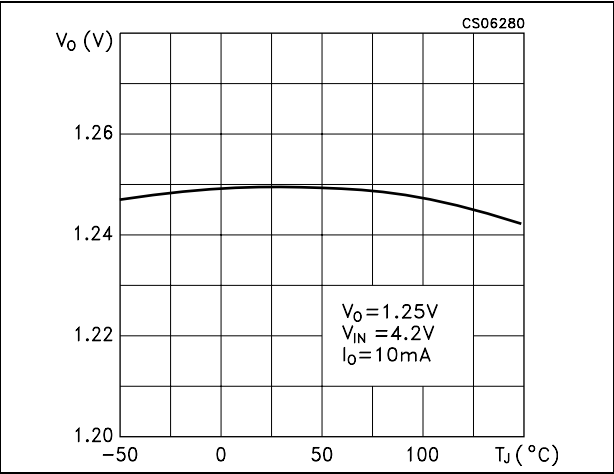


Figure 18. Load regulation vs temperature

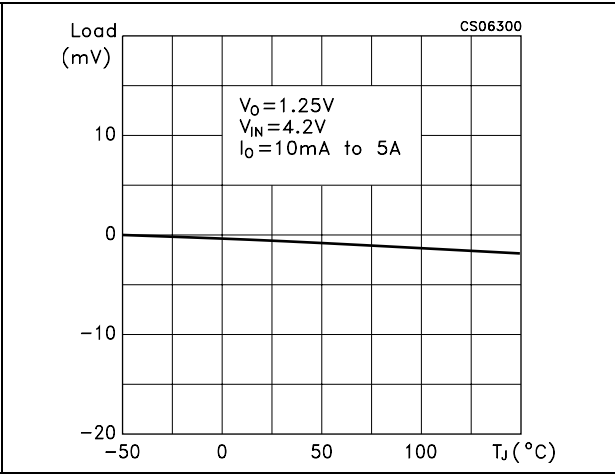


Figure 19. Adjust pin current vs temperature

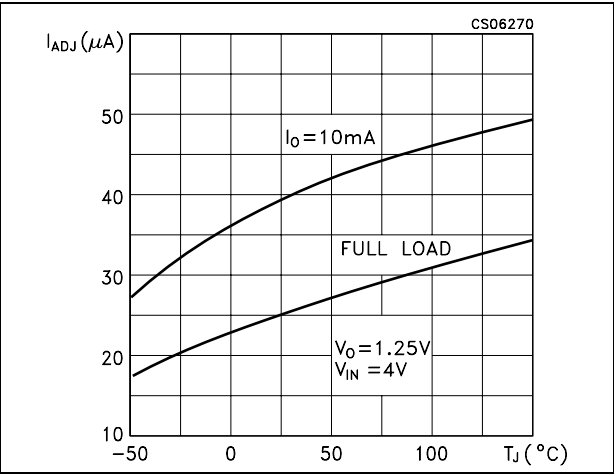


Figure 20. Line regulation vs temperature

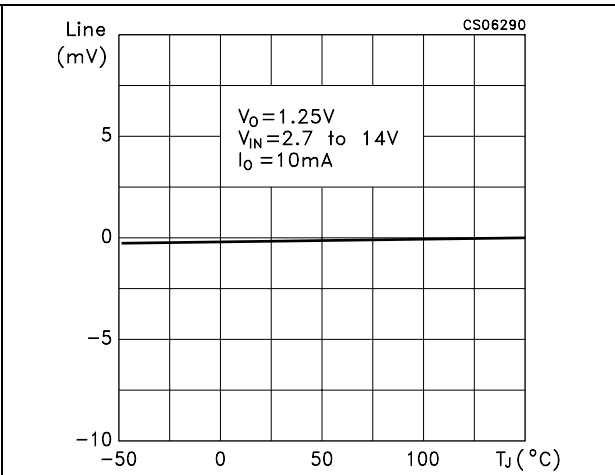


Figure 21. Minimum load current vs temperature

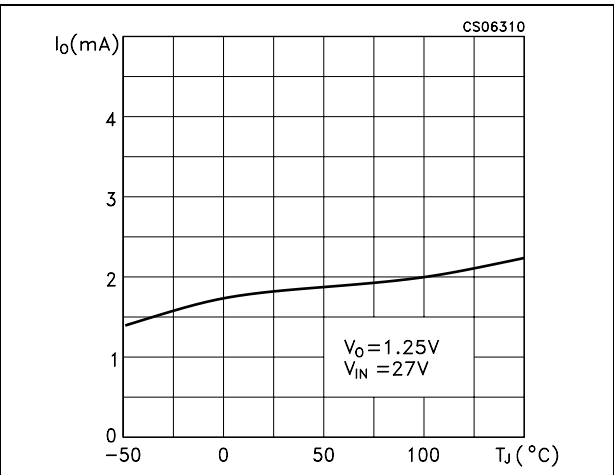


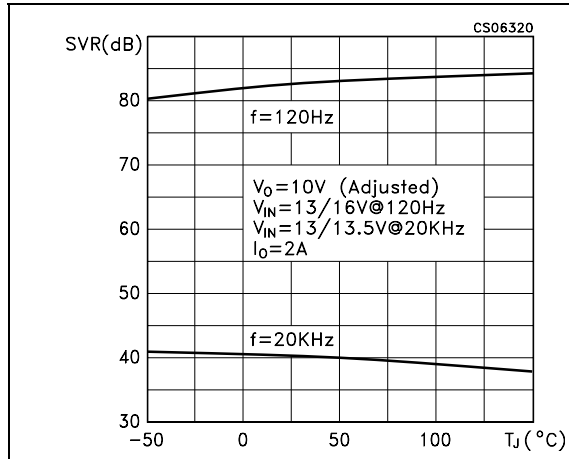
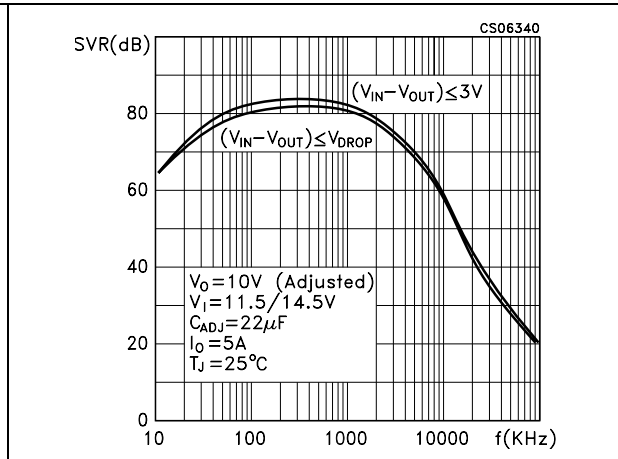
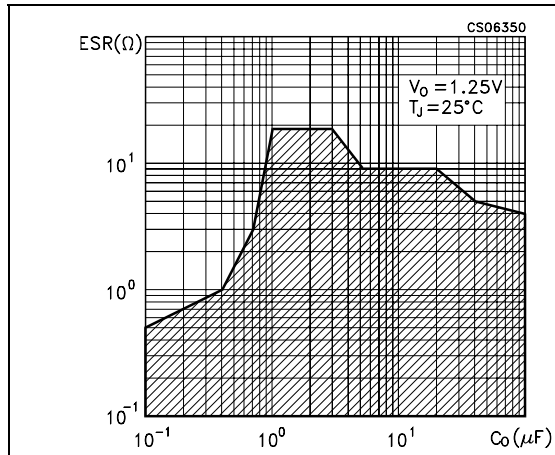
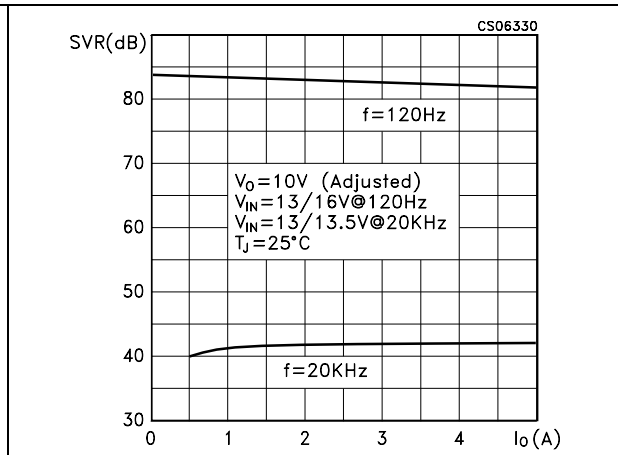
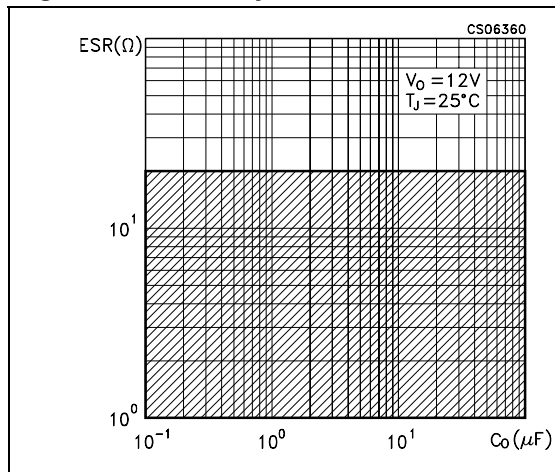
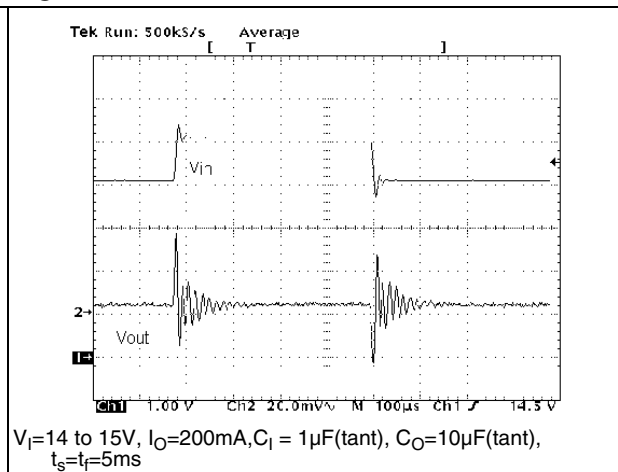
Figure 22. Supply voltage rejection vs temperature**Figure 23. Supply voltage rejection vs frequency****Figure 24. Stability****Figure 25. Supply voltage rejection vs output current****Figure 26. Stability****Figure 27. Line transient**

Figure 28. Line transient

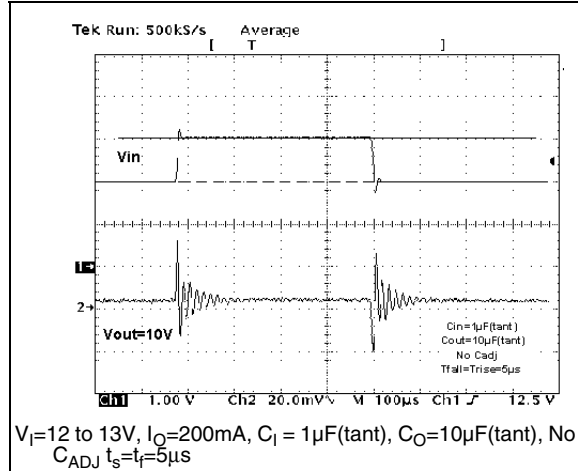


Figure 29. Load transient

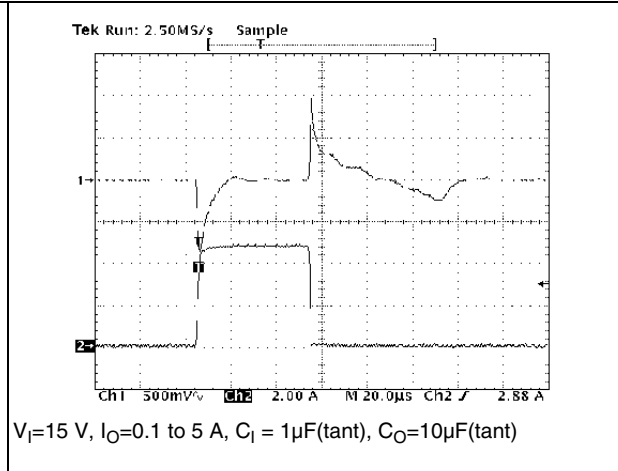


Figure 30. Load transient

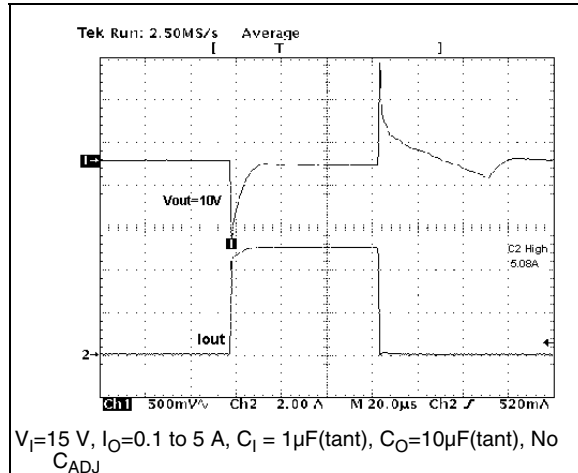


Figure 31. Line transient

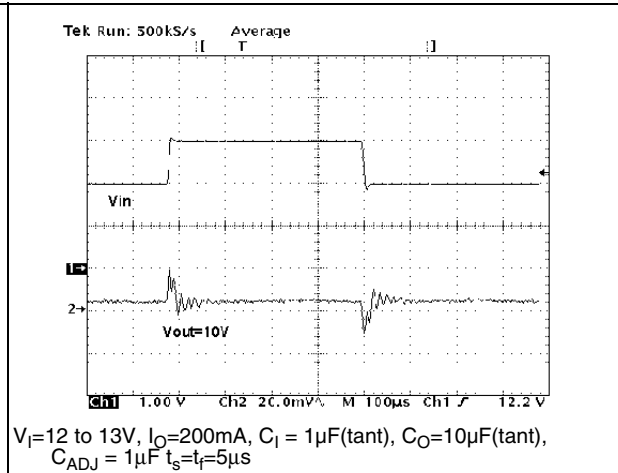
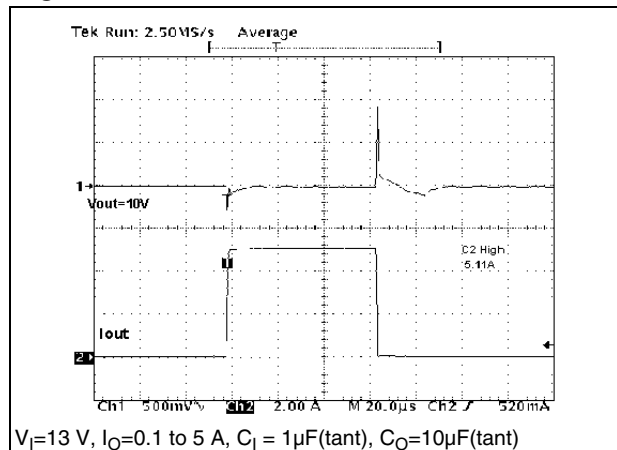


Figure 32. Load Transient

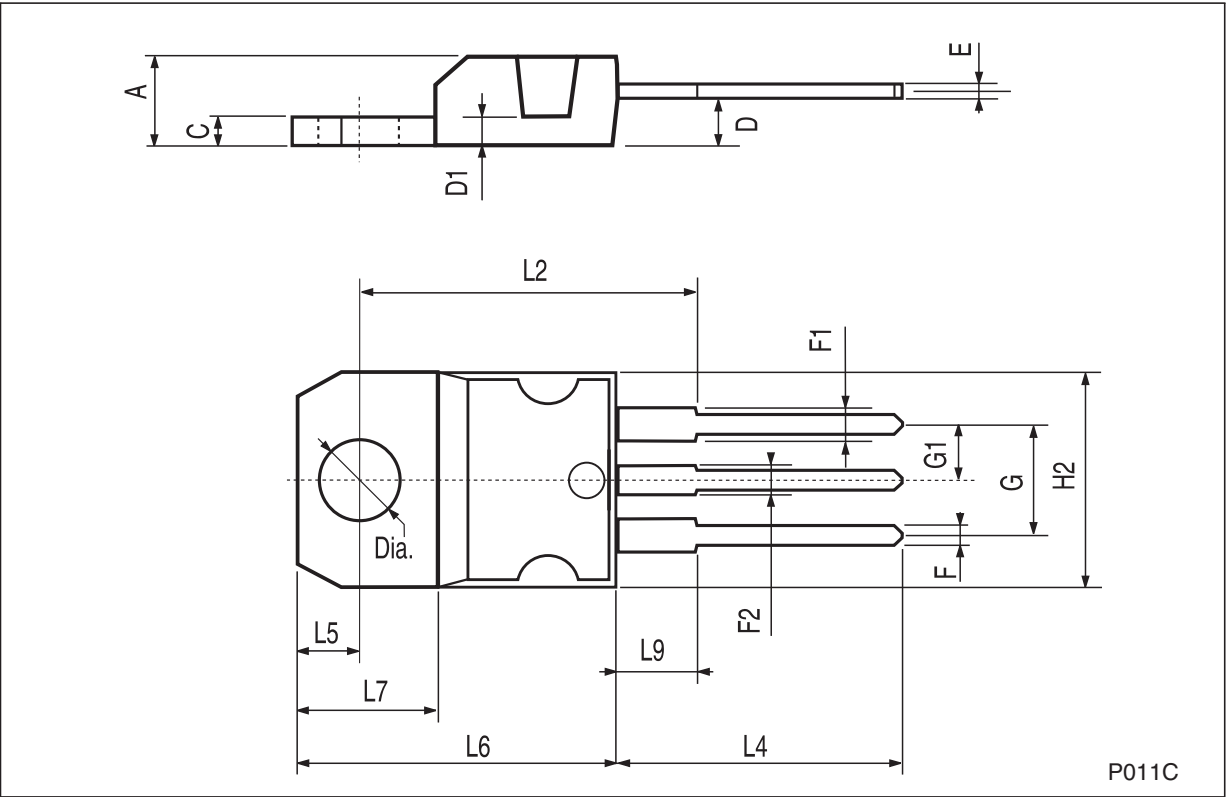


7 Package mechanical data

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



8 Revision history

Table 8. Document revision history

Date	Revision	Changes
07-Oct-2004	3	Mistake order codes - Table 1.
08-Feb-2005	4	Mistake U.M. Load Regulation - $V \Rightarrow mV$.
16-Jun-2005	5	Order codes updated.
04-Apr-2007	6	Order code updated.
07-Jun-2007	7	Order codes updated.
08-Apr-2008	8	Modified: Table 1 on page 1 . Removed: packages D ² PAK, D ² PAK/A and mechanical data.

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