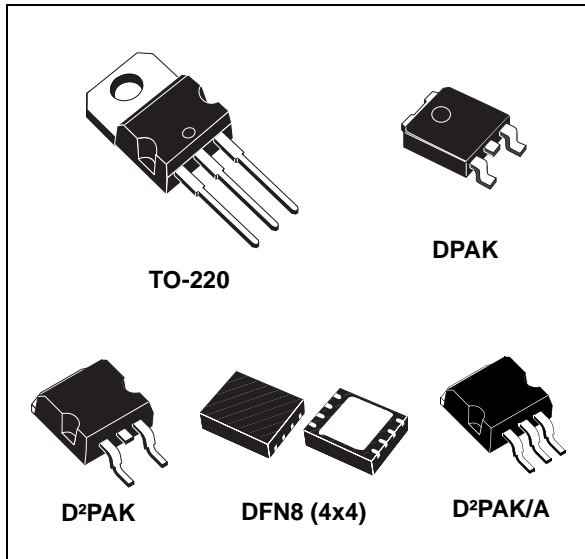


1.5 A adjustable and fixed low drop positive voltage regulator

Datasheet - production data



Description

The LD1086xx is a low drop voltage regulator capable of providing up to 1.5 A of output current. Dropout is guaranteed at a maximum of 1.2 V at the maximum output current, decreasing at lower loads. The LD1086xx is pin-to-pin compatible with older 3-terminal adjustable regulators, but has better performance in terms of drop and output tolerance. The 2.85 V output version is suitable for SCSI-2 active terminations. Unlike PNP regulators, where a part of the output current is wasted as quiescent current, the LD1086xx quiescent current flows into the load, increasing efficiency. Only a 10 μF (minimum) capacitor is needed for stability. The device is available in a TO-220, D²PAK, D²PAK/A, DPAK or DFN8 (4x4 mm) package. On-chip trimming allows the regulator to reach a very tight output voltage tolerance; within $\pm 1\%$ at 25 °C. The LD1086xx is available as automotive grade for adjustable output voltages in the TO-220 and DPAK packages. The PAT, SYL, SBL statistical tests have been performed, and the devices are qualified according to the AEC-Q100 specification for the automotive market in the temperature range of - 40 °C to 125 °C.

Features

- Typical dropout: 1.3 V at 1.5 A
- Three-terminal adjustable or fixed output voltage: 1.8 V, 2.5 V, 3.3 V, 5 V, 12 V
- Automotive grade (adjustable V_{OUT} in TO-220 and DPAK packages only)
- Output current guaranteed up to 1.5 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, D²PAK, D²PAK/A, DPAK and DFN8 (4 x 4 mm)
- Pinout compatibility with standard adjustable voltage regulators

Table 1. Device summary

Part numbers		
LD1086XX	LD1086XX18	LD1086XX33
LD1086XX12	LD1086XX25	LD1086XX50

Contents

1	Diagram	5
2	Pin configuration	6
3	Maximum ratings	7
4	Schematic application	8
5	Electrical characteristics	9
6	Typical application	18
7	Package mechanical data	23
8	Packaging mechanical data	43
9	Order codes	47
10	Revision history	48

List of tables

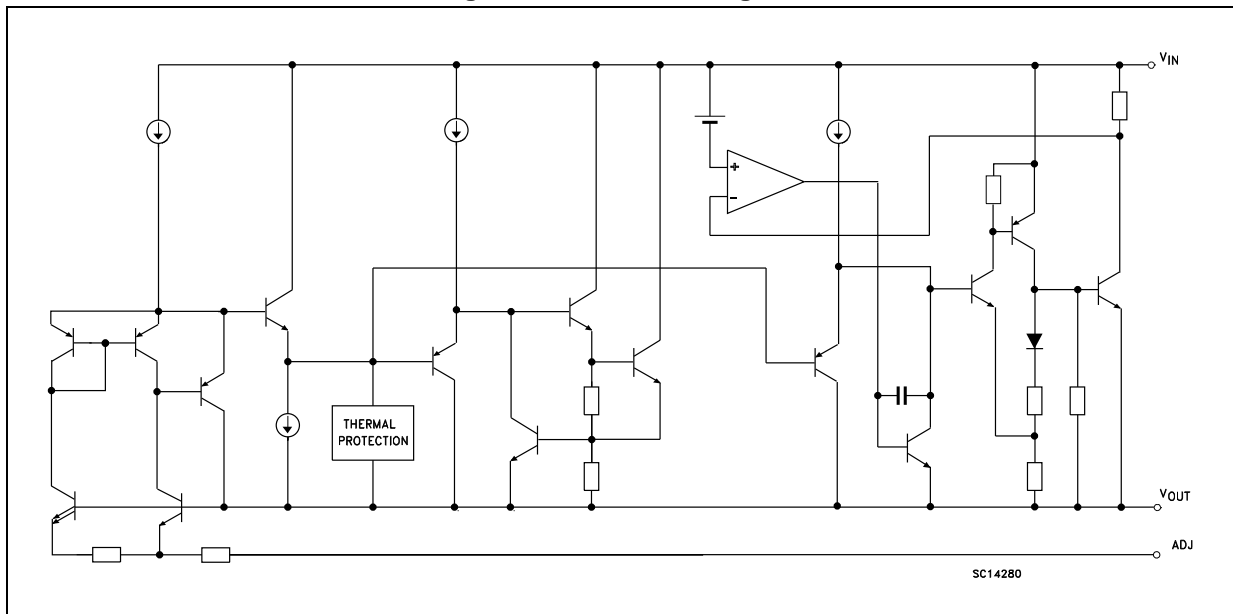
Table 1.	Device summary	1
Table 2.	Absolute maximum ratings	7
Table 3.	Thermal data	7
Table 4.	Electrical characteristics of LD1086#18	9
Table 5.	Electrical characteristics of LD1086#25	10
Table 6.	Electrical characteristics of LD1086#33	11
Table 7.	Electrical characteristics of LD1086#36	12
Table 8.	Electrical characteristics of LD1086#50	13
Table 9.	Electrical characteristics of LD1086#12	14
Table 10.	Electrical characteristics of LD1086B#	15
Table 11.	Electrical characteristics of LD1086#	16
Table 12.	Electrical characteristics of LD1086DTTRY and LD1086VY (Automotive grade)	17
Table 13.	TO-220 type A mechanical data	23
Table 14.	TO-220 SG (single gauge) mechanical data	25
Table 15.	DPAK mechanical data	27
Table 16.	D ² PAK (SMD 2L STD-ST) type A mechanical data	30
Table 17.	D ² PAK (SMD 2L Wooseok-Subcon.) type C mechanical data	32
Table 18.	DFN8L (4x4 mm.) mechanical data	35
Table 19.	D ² PAK (SMD 3L STD-ST) type A mechanical data	38
Table 20.	D ² PAK (SMD 3L Wooseok-Subcon.) type B mechanical data	40
Table 21.	DPAK and D ² PAK tape and reel mechanical data	43
Table 22.	Reel DFN8L dimensions	45
Table 23.	Order codes	47
Table 24.	Document revision history	48

List of figures

Figure 1.	Schematic diagram	5
Figure 2.	Pin connections (top view)	6
Figure 3.	Application circuit	8
Figure 4.	Output voltage vs. temp. ($V_I = 5\text{ V}$).	18
Figure 5.	Output voltage vs. temp. ($V_I = 15\text{ V}$).	18
Figure 6.	Output voltage vs. temperature ($V_I = 4.25\text{ V}$).	18
Figure 7.	Short circuit current vs. dropout voltage	18
Figure 8.	Line regulation vs. temperature	19
Figure 9.	Load regulation vs. temperature	19
Figure 10.	Dropout voltage vs. temperature	19
Figure 11.	Dropout voltage vs. output current	19
Figure 12.	Adjust pin current vs. input voltage	19
Figure 13.	Adjust pin current vs. temperature	19
Figure 14.	Adjust pin current vs. output current	20
Figure 15.	Quiescent current vs. output current.	20
Figure 16.	Quiescent current vs. input voltage	20
Figure 17.	Supply voltage rejection vs. output current.	20
Figure 18.	Supply voltage rejection vs. frequency	20
Figure 19.	Supply voltage rejection vs. temperature	20
Figure 20.	Minimum load current vs. temperature	21
Figure 21.	Stability for adjustable.	21
Figure 22.	Stability for 2.85 V.	21
Figure 23.	Stability for 12 V	21
Figure 24.	Line transient ($V_I = 12\text{ to }13\text{ V}$).	21
Figure 25.	Line transient ($I_O = 200\text{ mA}$).	21
Figure 26.	Line transient ($C_{ADJ} = 1\ \mu\text{F}$)	22
Figure 27.	Load transient.	22
Figure 28.	Load transient ($T_{rise} = T_{fall} = 10\ \mu\text{s}$)	22
Figure 29.	Thermal protection	22
Figure 30.	TO-220 type A drawing.	24
Figure 31.	TO-220 SG (single gauge) drawing	26
Figure 32.	DPAK drawing	28
Figure 33.	DPAK footprint	29
Figure 34.	D ² PAK (SMD 2L STD-ST) type A drawing	31
Figure 35.	D ² PAK (SMD 2L Wooseok-Subcon.) type C drawing	33
Figure 36.	D ² PAK (SMD 2L) footprint recommended	34
Figure 37.	DFN8L package outline	36
Figure 38.	DFN8L footprint recommended	37
Figure 39.	D ² PAK (SMD 3L STD-ST) type A mechanical data	39
Figure 40.	D ² PAK (SMD 3L Wooseok-Subcon.) type B drawing	41
Figure 41.	D ² PAK (SMD 3L) footprint recommended	42
Figure 42.	DPAK and D ² PAK footprint.	43
Figure 43.	Tape for DPAK and D ² PAK	44
Figure 44.	Reel for DPAK and D ² PAK.	44
Figure 45.	DFN8L carrier tape (dimension are in mm.)	45
Figure 46.	Reel DFN8L drawing	46

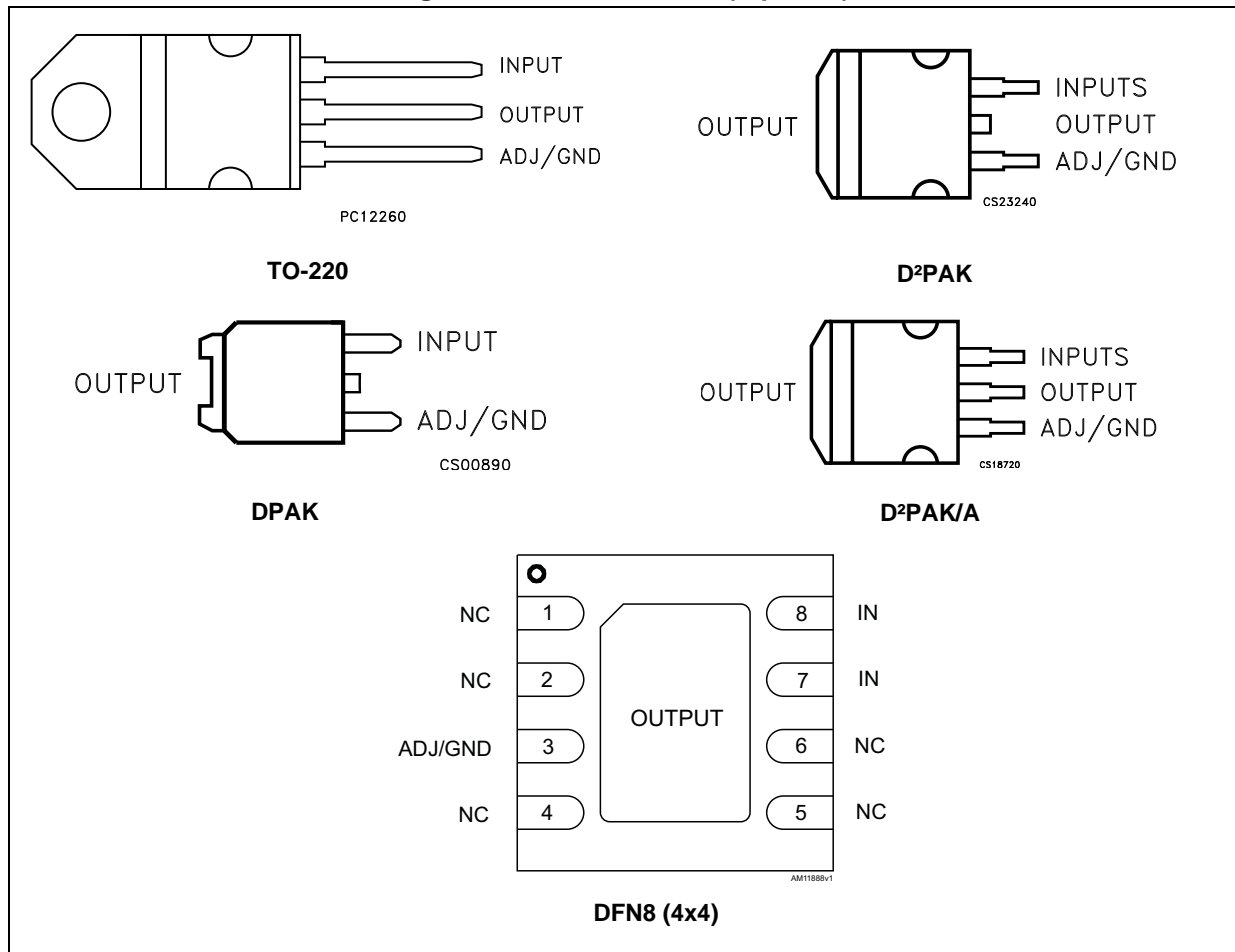
1 Diagram

Figure 1. Schematic diagram



2 Pin configuration

Figure 2. Pin connections (top view)



Note: The TAB is physically connected to the output (this is valid for the TO-220 package too).

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

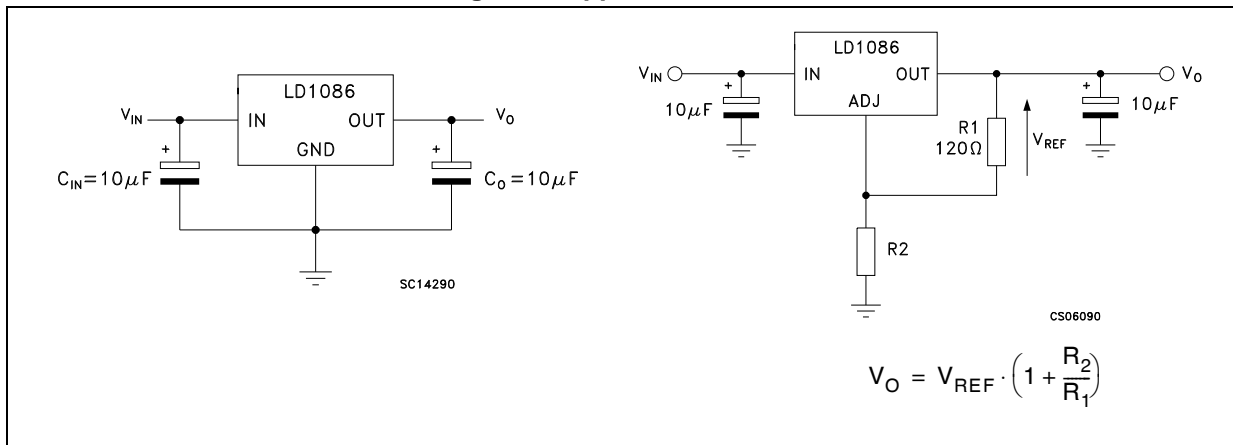
Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

Table 3. Thermal data

Symbol	Parameter	TO-220	D ² PAK D ² PAK/A	DPAK	DFN8	Unit
R_{thJC}	Thermal resistance junction-case	5	3	8	1.5	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	62.5	100	33	°C/W

4 Schematic application

Figure 3. Application circuit



5 Electrical characteristics

$V_I = 4.8 \text{ V}$, $C_I = C_O = 10 \mu\text{F}$, $T_A = -40 \text{ to } 125 \text{ }^\circ\text{C}$, unless otherwise specified.

Table 4. Electrical characteristics of LD1086#18

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_O	Output voltage ⁽¹⁾	$I_O = 0 \text{ mA}$, $T_J = 25 \text{ }^\circ\text{C}$	1.782	1.8	1.818	V
		$I_O = 0 \text{ to } 1.5 \text{ A}$, $V_I = 3.4 \text{ to } 30 \text{ V}$	1.764	1.8	1.836	V
ΔV_O	Line regulation	$I_O = 0 \text{ mA}$, $V_I = 3.4 \text{ to } 18 \text{ V}$, $T_J = 25 \text{ }^\circ\text{C}$		0.2	4	mV
		$I_O = 0 \text{ mA}$, $V_I = 3.4 \text{ to } 15 \text{ V}$		0.4	4	mV
ΔV_O	Load regulation	$I_O = 0 \text{ to } 1.5 \text{ A}$, $T_J = 25 \text{ }^\circ\text{C}$		0.5	8	mV
		$I_O = 0 \text{ to } 1.5 \text{ A}$		1	16	mV
V_d	Dropout voltage	$I_O = 1.5 \text{ A}$		1.3	1.5	V
I_q	Quiescent current	$V_I \leq 30 \text{ V}$		5	10	mA
I_{sc}	Short circuit current	$V_I - V_O = 5 \text{ V}$	1.5	2		A
		$V_I - V_O = 25 \text{ V}$	0.05	0.02		A
	Thermal regulation	$T_A = 25 \text{ }^\circ\text{C}$, 30 ms pulse		0.01	0.04	%/W
SVR	Supply voltage rejection	$f = 120 \text{ Hz}$, $C_O = 25 \mu\text{F}$, $I_O = 1.5 \text{ A}$ $V_I = 6.8 \pm 3 \text{ V}$	60	82		dB
eN	RMS output noise voltage (% of V_O)	$T_A = 25 \text{ }^\circ\text{C}$, $f = 10 \text{ Hz to } 10 \text{ kHz}$		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	$T_A = 125 \text{ }^\circ\text{C}$, 1000 Hrs		0.5		%

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

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

Table 5. Electrical characteristics of LD1086#25

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_O	Output voltage ⁽¹⁾	$I_O = 0 \text{ mA}$, $T_J = 25 \text{ }^\circ\text{C}$	2.475	2.5	2.525	V
		$I_O = 0 \text{ to } 1.5 \text{ A}$, $V_I = 4.1 \text{ to } 30 \text{ V}$	2.45	2.5	2.55	V
ΔV_O	Line regulation	$I_O = 0 \text{ mA}$, $V_I = 4.1 \text{ to } 18 \text{ V}$, $T_J = 25^\circ\text{C}$		0.2	4	mV
		$I_O = 0 \text{ mA}$, $V_I = 4.1 \text{ to } 18 \text{ V}$		0.4	4	mV
ΔV_O	Load regulation	$I_O = 0 \text{ to } 1.5 \text{ A}$, $T_J = 25 \text{ }^\circ\text{C}$		0.5	8	mV
		$I_O = 0 \text{ to } 1.5 \text{ A}$		1	16	mV
V_d	Dropout voltage	$I_O = 1.5 \text{ A}$		1.3	1.5	V
I_q	Quiescent current	$V_I \leq 30 \text{ V}$		5	10	mA
I_{sc}	Short circuit current	$V_I - V_O = 5 \text{ V}$	1.5	2		A
		$V_I - V_O = 25 \text{ V}$	0.05	0.2		A
	Thermal regulation	$T_A = 25 \text{ }^\circ\text{C}$, 30 ms pulse		0.008	0.04	%/W
SVR	Supply voltage rejection	$f = 120 \text{ Hz}$, $C_O = 25 \mu\text{F}$, $I_O = 1.5 \text{ A}$ $V_I = 7.5 \pm 3 \text{ V}$	60	81		dB
eN	RMS output noise voltage (% of V_O)	$T_A = 25 \text{ }^\circ\text{C}$, $f = 10 \text{ Hz to } 10 \text{ kHz}$		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	$T_A = 125 \text{ }^\circ\text{C}$, 1000 Hrs		0.5		%

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

$V_I = 6.3 \text{ V}$, $C_I = C_O = 10 \mu\text{F}$, $T_A = -40 \text{ to } 125 \text{ }^\circ\text{C}$, unless otherwise specified.

Table 6. Electrical characteristics of LD1086#33

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_O	Output voltage ⁽¹⁾	$I_O = 0 \text{ mA}$, $T_J = 25 \text{ }^\circ\text{C}$	3.267	3.3	3.333	V
		$I_O = 0 \text{ to } 1.5 \text{ A}$, $V_I = 4.9 \text{ to } 30 \text{ V}$	3.234	3.3	3.366	V
ΔV_O	Line regulation	$I_O = 0 \text{ mA}$, $V_I = 4.9 \text{ to } 18 \text{ V}$, $T_J = 25 \text{ }^\circ\text{C}$		0.5	6	mV
		$I_O = 0 \text{ mA}$, $V_I = 4.9 \text{ to } 18 \text{ V}$		1	6	mV
ΔV_O	Load regulation	$I_O = 0 \text{ to } 1.5 \text{ A}$, $T_J = 25 \text{ }^\circ\text{C}$		1	10	mV
		$I_O = 0 \text{ to } 1.5 \text{ A}$		7	25	mV
V_d	Dropout voltage	$I_O = 1.5 \text{ A}$		1.3	1.5	V
I_q	Quiescent current	$V_I \leq 30 \text{ V}$		5	10	mA
I_{sc}	Short-circuit current	$V_I - V_O = 5 \text{ V}$	1.5	2		A
		$V_I - V_O = 25 \text{ V}$	0.05	0.2		A
	Thermal regulation	$T_A = 25 \text{ }^\circ\text{C}$, 30 ms pulse		0.008	0.04	%/W
SVR	Supply voltage rejection	$f = 120 \text{ Hz}$, $C_O = 25 \mu\text{F}$, $I_O = 1.5 \text{ A}$ $V_I = 8.3 \pm 3 \text{ V}$	60	79		dB
eN	RMS output noise voltage (% of V_O)	$T_A = 25 \text{ }^\circ\text{C}$, $f = 10 \text{ Hz to } 10 \text{ kHz}$		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	$T_A = 125 \text{ }^\circ\text{C}$, 1000 Hrs		0.5		%

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

$V_I = 6.6 \text{ V}$, $C_I = C_O = 10 \mu\text{F}$, $T_A = -40 \text{ to } 125 \text{ }^\circ\text{C}$, unless otherwise specified.

Table 7. Electrical characteristics of LD1086#36

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_O	Output voltage ⁽¹⁾	$I_O = 0 \text{ mA}$, $T_J = 25 \text{ }^\circ\text{C}$	3.564	3.6	3.636	V
		$I_O = 0 \text{ to } 1.5 \text{ A}$, $V_I = 5.2 \text{ to } 30 \text{ V}$	3.528	3.6	3.672	V
ΔV_O	Line regulation	$I_O = 0 \text{ mA}$, $V_I = 5.2 \text{ to } 18 \text{ V}$, $T_J = 25 \text{ }^\circ\text{C}$		0.5	10	mV
		$I_O = 0 \text{ mA}$, $V_I = 5.2 \text{ to } 18 \text{ V}$		1	10	mV
ΔV_O	Load regulation	$I_O = 0 \text{ to } 1.5 \text{ A}$, $T_J = 25 \text{ }^\circ\text{C}$		3	15	mV
		$I_O = 0 \text{ to } 1.5 \text{ A}$		7	25	mV
V_d	Dropout voltage	$I_O = 1.5 \text{ A}$		1.3	1.5	V
I_q	Quiescent current	$V_I \leq 30 \text{ V}$		5	10	mA
I_{sc}	Short circuit current	$V_I - V_O = 5 \text{ V}$	1.5	2		A
		$V_I - V_O = 25 \text{ V}$	0.05	0.2		A
	Thermal regulation	$T_A = 25 \text{ }^\circ\text{C}$, 30 ms pulse		0.01	0.04	%/W
SVR	Supply voltage rejection	$f = 120 \text{ Hz}$, $C_O = 25 \mu\text{F}$, $I_O = 1.5 \text{ A}$ $V_I = 8.6 \pm 3 \text{ V}$	60	78		dB
eN	RMS output noise voltage (% of V_O)	$T_A = 25 \text{ }^\circ\text{C}$, $f = 10 \text{ Hz to } 10 \text{ kHz}$		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	$T_A = 125 \text{ }^\circ\text{C}$, 1000 Hrs		0.5		%

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

$V_I = 8\text{ V}$, $C_I = C_O = 10\ \mu\text{F}$, $T_A = -40\text{ to }125\text{ }^\circ\text{C}$, unless otherwise specified.

Table 8. Electrical characteristics of LD1086#50

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_O	Output voltage ⁽¹⁾	$I_O = 0\text{ mA}$, $T_J = 25\text{ }^\circ\text{C}$	4.95	5	5.05	V
		$I_O = 0\text{ to }1.5\text{ A}$, $V_I = 6.6\text{ to }30\text{ V}$	4.9	5	5.1	V
ΔV_O	Line regulation	$I_O = 0\text{ mA}$, $V_I = 6.6\text{ to }20\text{ V}$, $T_J = 25\text{ }^\circ\text{C}$		0.5	10	mV
		$I_O = 0\text{ mA}$, $V_I = 6.6\text{ to }20\text{ V}$		1	10	mV
ΔV_O	Load regulation	$I_O = 0\text{ to }1.5\text{ A}$, $T_J = 25\text{ }^\circ\text{C}$		5	20	mV
		$I_O = 0\text{ to }1.5\text{ A}$		10	35	mV
V_d	Dropout voltage	$I_O = 1.5\text{ A}$		1.3	1.5	V
I_q	Quiescent current	$V_I \leq 30\text{ V}$		5	10	mA
I_{sc}	Short circuit current	$V_I - V_O = 5\text{ V}$	1.5	2		A
		$V_I - V_O = 25\text{ V}$	0.05	0.2		A
	Thermal regulation	$T_A = 25\text{ }^\circ\text{C}$, 30 ms pulse		0.01	0.04	%/W
SVR	Supply voltage rejection	$f = 120\text{ Hz}$, $C_O = 25\ \mu\text{F}$, $I_O = 1.5\text{ A}$ $V_I = 10 \pm 3\text{ V}$	60	75		dB
eN	RMS output noise voltage (% of V_O)	$T_A = 25\text{ }^\circ\text{C}$, $f = 10\text{ Hz to }10\text{ kHz}$		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	$T_A = 125\text{ }^\circ\text{C}$, 1000 Hrs		0.5		%

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

$V_I = 15\text{ V}$, $C_I = C_O = 10\ \mu\text{F}$, $T_A = -40\text{ to }125\text{ }^\circ\text{C}$, unless otherwise specified.

Table 9. Electrical characteristics of LD1086#12

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_O	Output voltage ⁽¹⁾	$I_O = 0\text{ mA}$, $T_J = 25\text{ }^\circ\text{C}$	11.88	12	12.12	V
		$I_O = 0\text{ to }1.5\text{ A}$, $V_I = 13.8\text{ to }30\text{ V}$	11.76	12	12.24	V
ΔV_O	Line regulation	$I_O = 0\text{ mA}$, $V_I = 13.8\text{ to }25\text{ V}$, $T_J = 25\text{ }^\circ\text{C}$		1	25	mV
		$I_O = 0\text{ mA}$, $V_I = 13.8\text{ to }25\text{ V}$		2	25	mV
ΔV_O	Load regulation	$I_O = 0\text{ to }1.5\text{ A}$, $T_J = 25\text{ }^\circ\text{C}$		12	36	mV
		$I_O = 0\text{ to }1.5\text{ A}$		24	72	mV
V_d	Dropout voltage	$I_O = 1.5\text{ A}$		1.3	1.5	V
I_q	Quiescent current	$V_I \leq 30\text{ V}$		5	10	mA
I_{sc}	Short circuit current	$V_I - V_O = 5\text{ V}$	1.5	2		A
		$V_I - V_O = 25\text{ V}$	0.05	0.2		A
	Thermal regulation	$T_A = 25\text{ }^\circ\text{C}$, 30 ms pulse		0.01	0.04	%/W
SVR	Supply voltage rejection	$f = 120\text{ Hz}$, $C_O = 25\ \mu\text{F}$, $I_O = 1.5\text{ A}$ $V_I = 17 \pm 3\text{ V}$	54	66		dB
eN	RMS output noise voltage (% of V_O)	$T_A = 25\text{ }^\circ\text{C}$, $f = 10\text{ Hz to }10\text{ kHz}$		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	$T_A = 125\text{ }^\circ\text{C}$, 1000 Hrs		0.5		%

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

$V_I = 4.25 \text{ V}$, $C_I = C_O = 10 \mu\text{F}$, $T_A = -40 \text{ to } 125 \text{ }^\circ\text{C}$, unless otherwise specified.

Table 10. Electrical characteristics of LD1086B#

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_{ref}	Reference voltage ⁽¹⁾	$I_O = 10 \text{ mA}$, $T_J = 25 \text{ }^\circ\text{C}$	1.231	1.25	1.269	V
		$I_O = 10 \text{ mA}$ to 1.5 A , $V_I = 2.85$ to 30 V	1.219	1.25	1.281	V
ΔV_O	Line regulation	$I_O = 10 \text{ mA}$, $V_I = 2.8$ to 16.5 V , $T_J = 25 \text{ }^\circ\text{C}$		0.015	0.2	%
		$I_O = 10 \text{ mA}$, $V_I = 2.8$ to 16.5 V		0.035	0.2	%
ΔV_O	Load regulation	$I_O = 10 \text{ mA}$ to 1.5 A , $T_J = 25 \text{ }^\circ\text{C}$		0.1	0.3	%
		$I_O = 0$ to 1.5 A		0.2	0.4	%
V_d	Dropout voltage	$I_O = 1.5 \text{ A}$		1.3	1.5	V
$I_{O(\text{min})}$	Minimum load current	$V_I = 30 \text{ V}$		3	10	mA
I_{sc}	Short circuit current	$V_I - V_O = 5 \text{ V}$	1.5	2.3		A
		$V_I - V_O = 25 \text{ V}$	0.05	0.2		A
	Thermal regulation	$T_A = 25 \text{ }^\circ\text{C}$, 30 ms pulse		0.01	0.04	%/W
SVR	Supply voltage rejection	$f = 120 \text{ Hz}$, $C_O = 25 \mu\text{F}$, $C_{\text{ADJ}} = 25 \mu\text{F}$, $I_O = 1.5 \text{ A}$, $V_I = 6.25 \pm 3 \text{ V}$	60	88		dB
I_{ADJ}	Adjust pin current	$V_I = 4.25 \text{ V}$, $I_O = 10 \text{ mA}$		40	120	μA
ΔI_{ADJ}	Adjust pin current change ⁽¹⁾	$I_O = 10 \text{ mA}$ to 1.5 A , $V_I = 2.8$ to 16.5 V		0.2	5	μA
eN	RMS output noise voltage (% of V_O)	$T_A = 25 \text{ }^\circ\text{C}$, $f = 10 \text{ Hz}$ to 10 kHz		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	$T_A = 125 \text{ }^\circ\text{C}$, 1000 Hrs		0.5		%

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

$V_I = 4.25 \text{ V}$, $C_I = C_O = 10 \mu\text{F}$, $T_A = -40 \text{ to } 125 \text{ }^\circ\text{C}$, unless otherwise specified.

Table 11. Electrical characteristics of LD1086#

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_{ref}	Reference voltage ⁽¹⁾	$I_O = 10 \text{ mA}$, $T_J = 25 \text{ }^\circ\text{C}$	1.237	1.25	1.263	V
		$I_O = 10 \text{ mA}$ to 1.5 A , $V_I = 2.85$ to 30 V	1.225	1.25	1.275	V
ΔV_O	Line regulation	$I_O = 10 \text{ mA}$, $V_I = 2.8$ to 16.5 V , $T_J = 25 \text{ }^\circ\text{C}$		0.015	0.2	%
		$I_O = 10 \text{ mA}$, $V_I = 2.8$ to 16.5 V		0.035	0.2	%
ΔV_O	Load regulation	$I_O = 10 \text{ mA}$ to 1.5 A , $T_J = 25 \text{ }^\circ\text{C}$		0.1	0.3	%
		$I_O = 0$ to 1.5 A		0.2	0.4	%
V_d	Dropout voltage	$I_O = 1.5 \text{ A}$		1.3	1.5	V
$I_{O(\text{min})}$	Minimum load current	$V_I = 30 \text{ V}$		3	10	mA
I_{sc}	Short circuit current	$V_I - V_O = 5 \text{ V}$	1.5	2.3		A
		$V_I - V_O = 25 \text{ V}$	0.05	0.2		A
	Thermal regulation	$T_A = 25 \text{ }^\circ\text{C}$, 30 ms pulse		0.01	0.04	%/W
SVR	Supply voltage rejection	$f = 120 \text{ Hz}$, $C_O = 25 \mu\text{F}$, $C_{\text{ADJ}} = 25 \mu\text{F}$, $I_O = 1.5 \text{ A}$, $V_I = 6.25 \pm 3 \text{ V}$	60	88		dB
I_{ADJ}	Adjust pin current	$V_I = 4.25 \text{ V}$, $I_O = 10 \text{ mA}$		40	120	μA
ΔI_{ADJ}	Adjust pin current change ⁽¹⁾	$I_O = 10 \text{ mA}$ to 1.5 A , $V_I = 2.8$ to 16.5 V		0.2	5	μA
eN	RMS output noise voltage (% of V_O)	$T_A = 25 \text{ }^\circ\text{C}$, $f = 10 \text{ Hz}$ to 10 kHz		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	$T_A = 125 \text{ }^\circ\text{C}$, 1000 Hrs		0.5		%

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

$V_I = 4.25\text{ V}$, $C_I = C_O = 10\ \mu\text{F}$, $T_A = -40\text{ to }125\text{ }^\circ\text{C}$, unless otherwise specified.

Table 12. Electrical characteristics of LD1086DTTRY and LD1086VY (Automotive grade)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_{ref}	Reference voltage ⁽¹⁾	$I_O = 10\text{ mA}$, $T_A = 25\text{ }^\circ\text{C}$	1.237	1.25	1.263	V
		$I_O = 10\text{ mA to }1.5\text{ A}$, $V_I = 2.85\text{ to }30\text{ V}$	1.225	1.25	1.275	V
ΔV_O	Line regulation	$I_O = 10\text{ mA}$, $V_I = 2.8\text{ to }16.5\text{ V}$		0.035	0.2	%
ΔV_O	Load regulation	$I_O = 0\text{ to }1.5\text{ A}$		0.2	0.4	%
V_d	Dropout voltage	$I_O = 1.5\text{ A}$		1.3	1.5	V
$I_{O(\text{min})}$	Minimum load current	$V_I = 30\text{ V}$		3	10	mA
I_{sc}	Short circuit current	$V_I - V_O = 5\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$	1.5	2.3		A
		$V_I - V_O = 25\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$	0.05	0.2		A
	Thermal regulation	$T_A = 25\text{ }^\circ\text{C}$, 30 ms pulse		0.01	0.04	%/W
SVR	Supply voltage rejection	$f = 120\text{ Hz}$, $C_O = 25\ \mu\text{F}$, $C_{\text{ADJ}} = 25\ \mu\text{F}$, $I_O = 1.5\text{ A}$, $V_I = 6.25 \pm 3\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$	60	88		dB
I_{ADJ}	Adjust pin current	$V_I = 4.25\text{ V}$, $I_O = 10\text{ mA}$		40	120	μA
ΔI_{ADJ}	Adjust pin current change ⁽¹⁾	$I_O = 10\text{ mA to }1.5\text{ A}$, $V_I = 2.8\text{ to }16.5\text{ V}$		0.2	5	μA
eN	RMS output noise voltage (% of V_O)	$T_A = 25\text{ }^\circ\text{C}$, $f = 10\text{ Hz to }10\text{ kHz}$		0.003		%
S	Temperature stability			0.5		%
S	Long term stability	$T_A = 125\text{ }^\circ\text{C}$, 1000 Hrs		0.5		%

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

6 Typical application

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

Figure 4. Output voltage vs. temp. ($V_I = 5\text{ V}$)

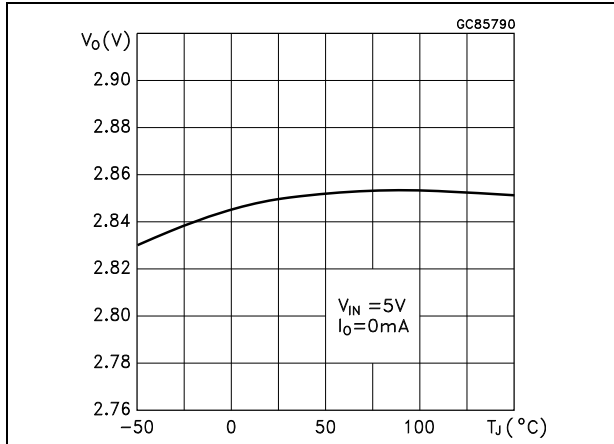


Figure 5. Output voltage vs. temp. ($V_I = 15\text{ V}$)

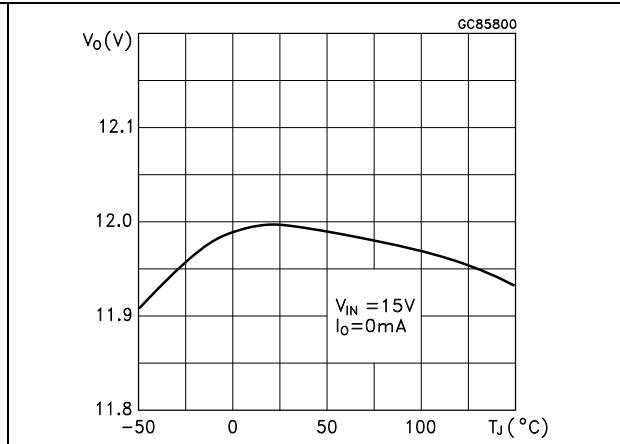


Figure 6. Output voltage vs. temperature ($V_I = 4.25\text{ V}$)

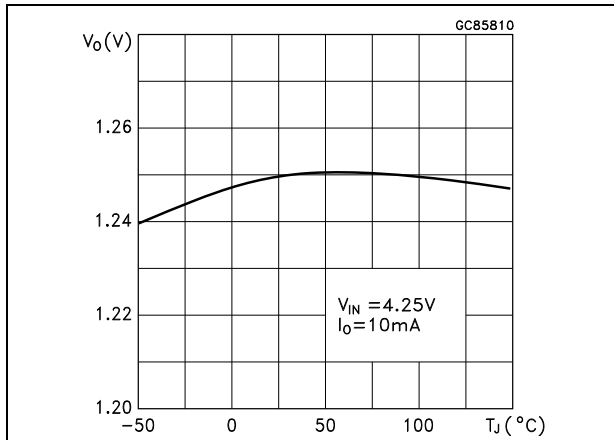


Figure 7. Short circuit current vs. dropout voltage

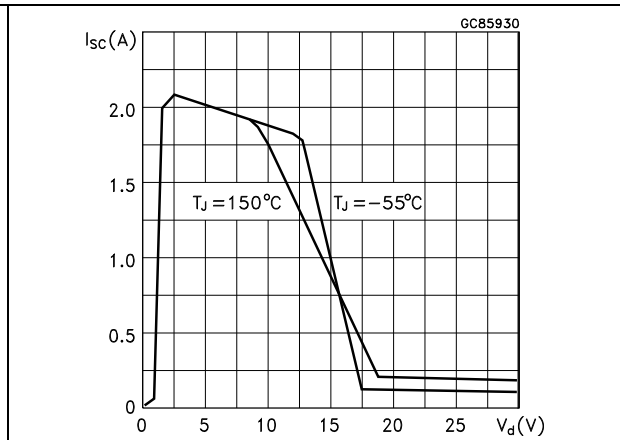


Figure 8. Line regulation vs. temperature

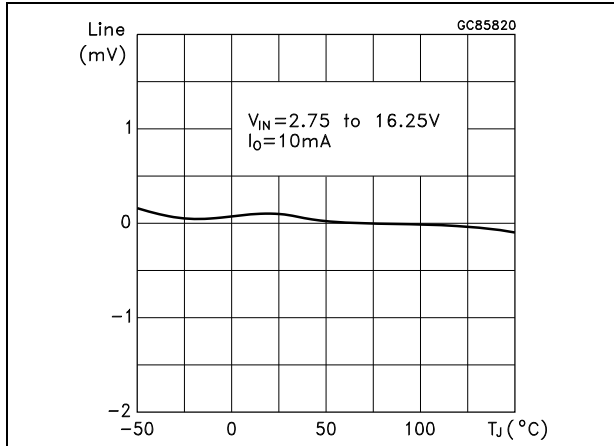


Figure 9. Load regulation vs. temperature

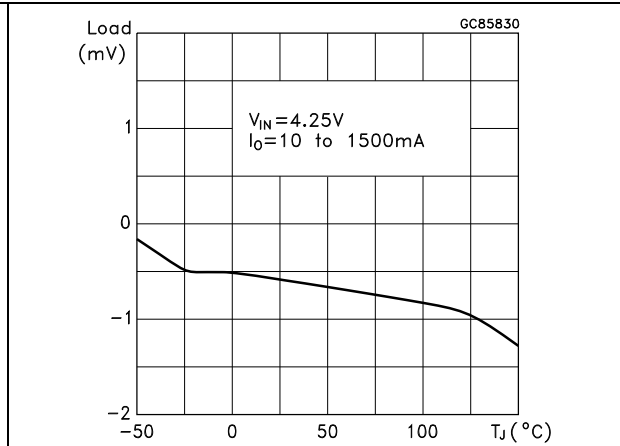


Figure 10. Dropout voltage vs. temperature

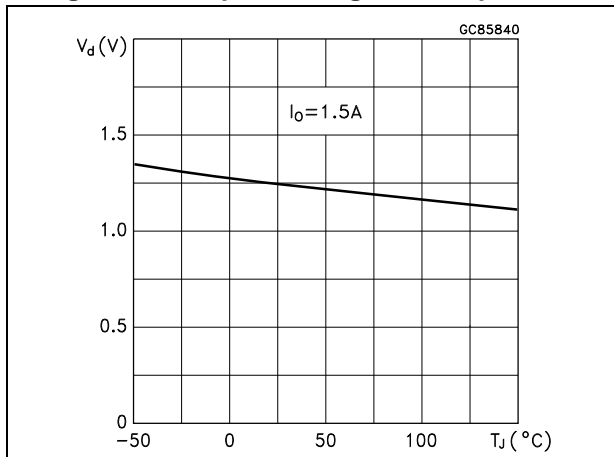


Figure 11. Dropout voltage vs. output current

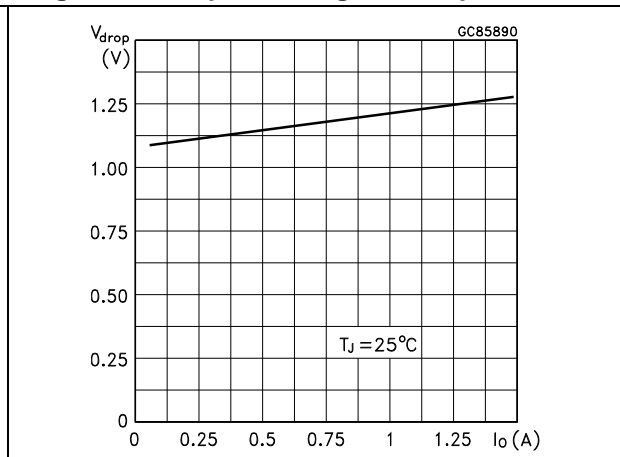


Figure 12. Adjust pin current vs. input voltage

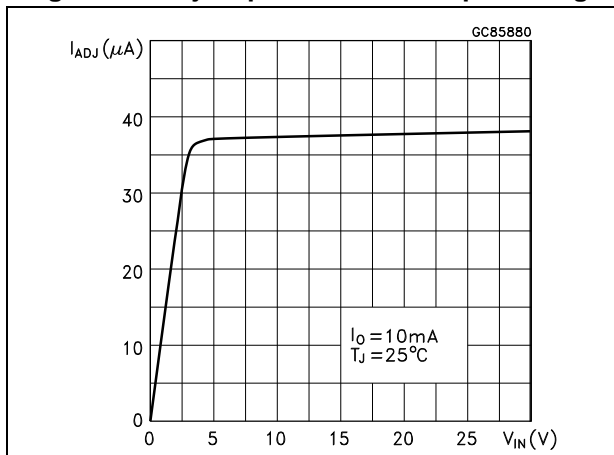


Figure 13. Adjust pin current vs. temperature

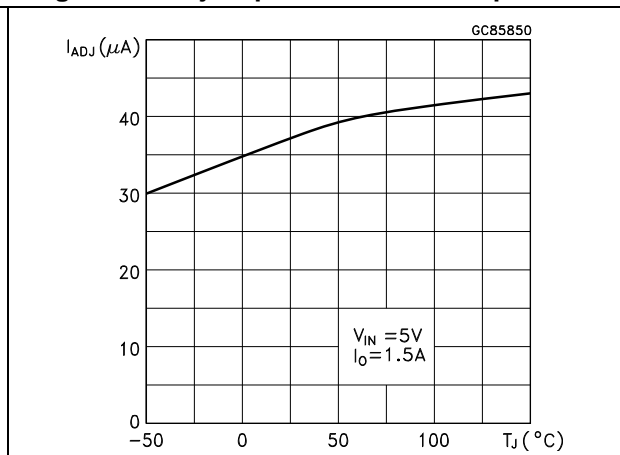


Figure 14. Adjust pin current vs. output current Figure 15. Quiescent current vs. output current

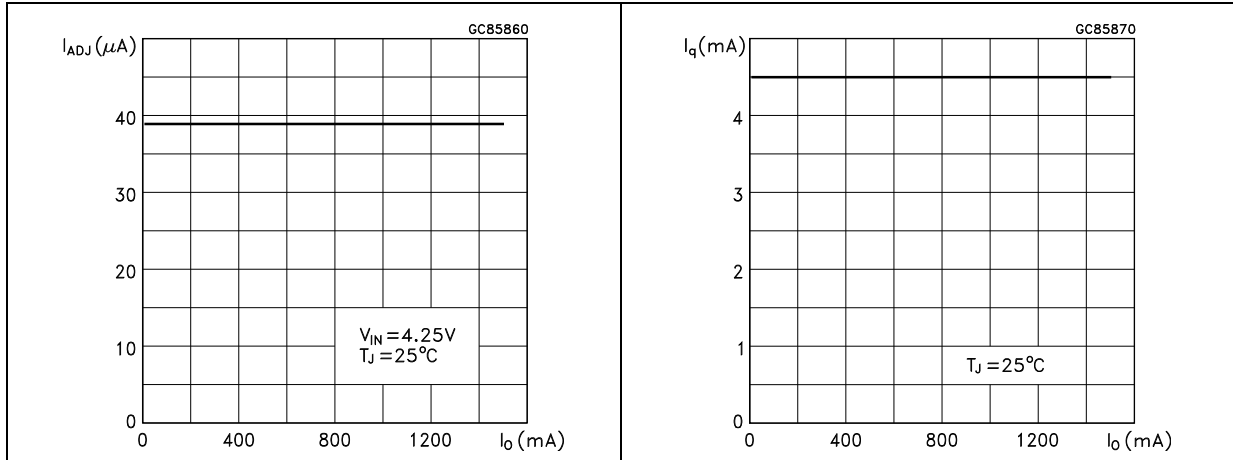


Figure 16. Quiescent current vs. input voltage Figure 17. Supply voltage rejection vs. output current

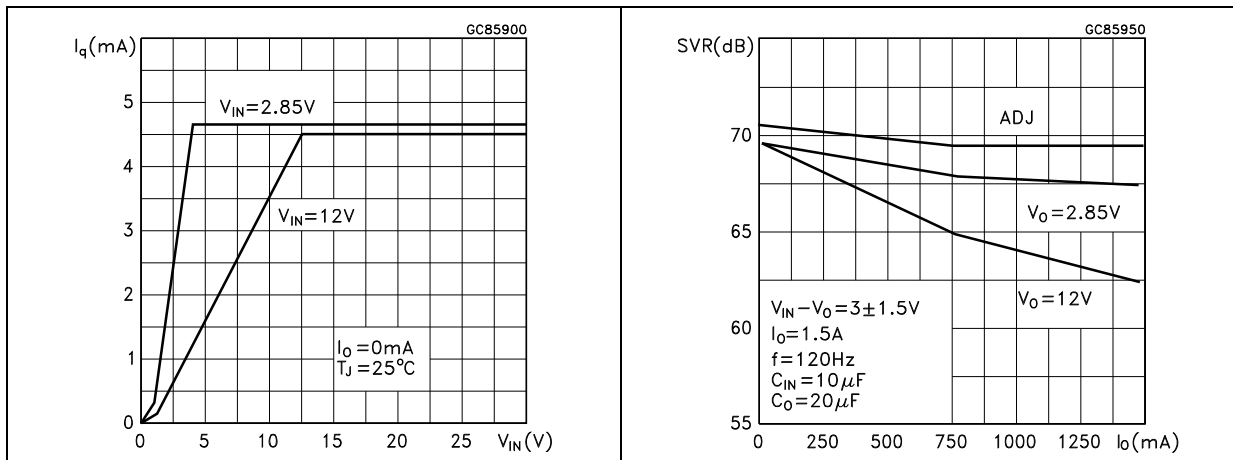


Figure 18. Supply voltage rejection vs. frequency Figure 19. Supply voltage rejection vs. temperature

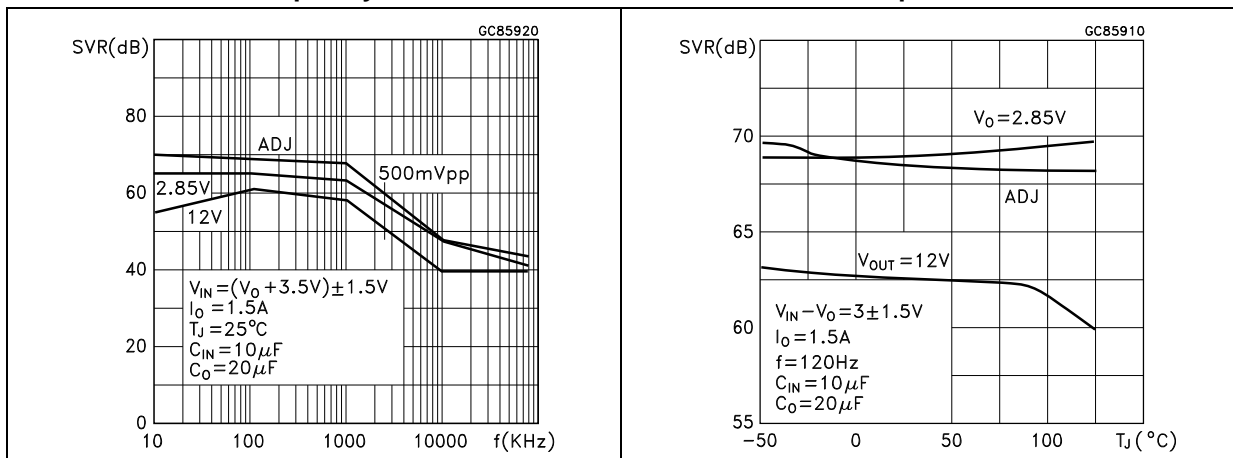


Figure 20. Minimum load current vs. temperature

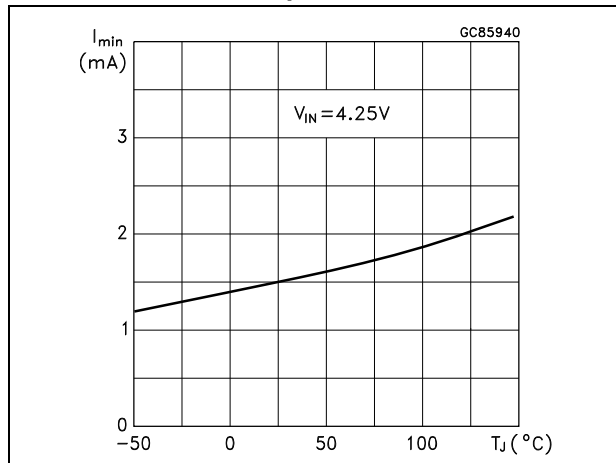


Figure 21. Stability for adjustable

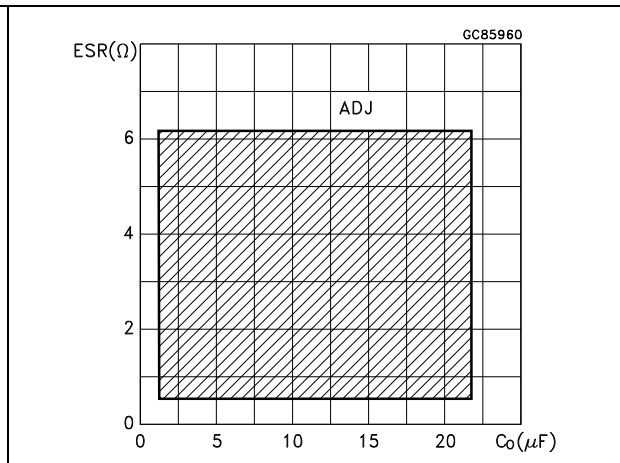


Figure 22. Stability for 2.85 V

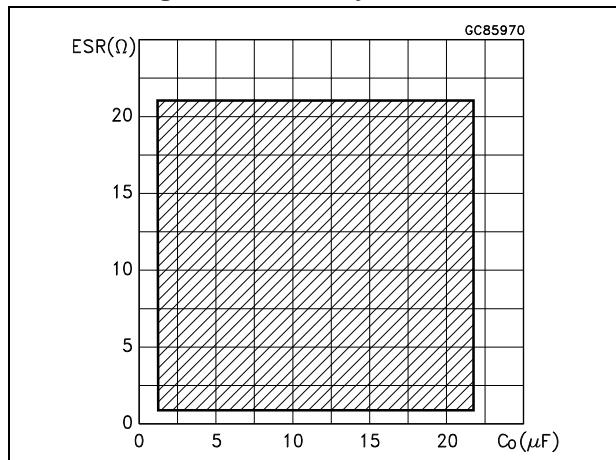


Figure 23. Stability for 12 V

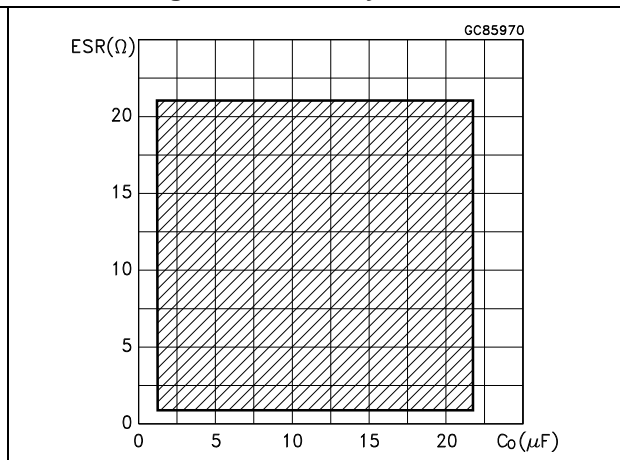


Figure 24. Line transient ($V_I = 12$ to 13 V)

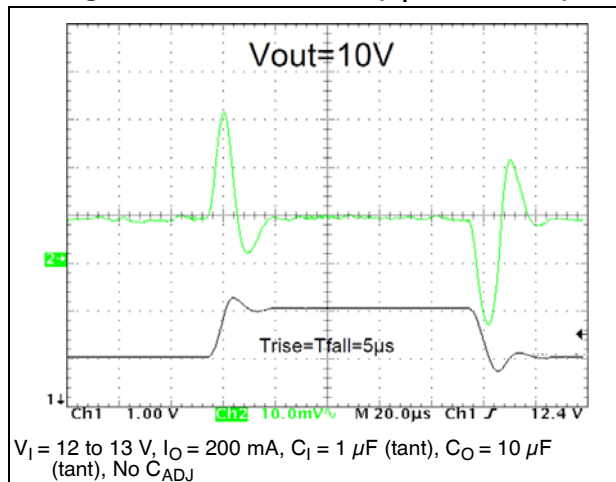


Figure 25. Line transient ($I_O = 200$ mA)

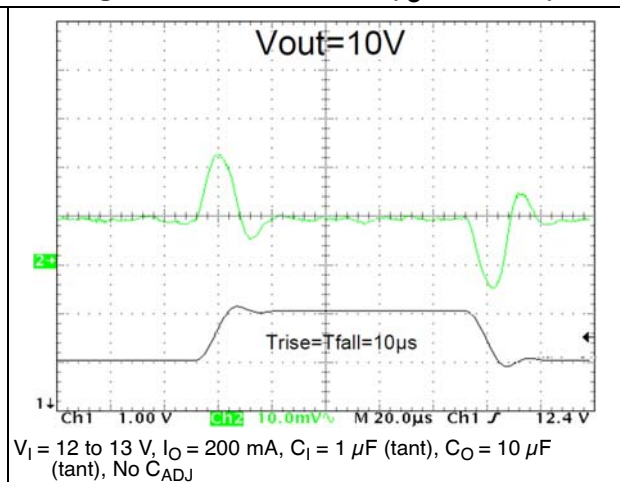


Figure 26. Line transient ($C_{ADJ} = 1 \mu F$)

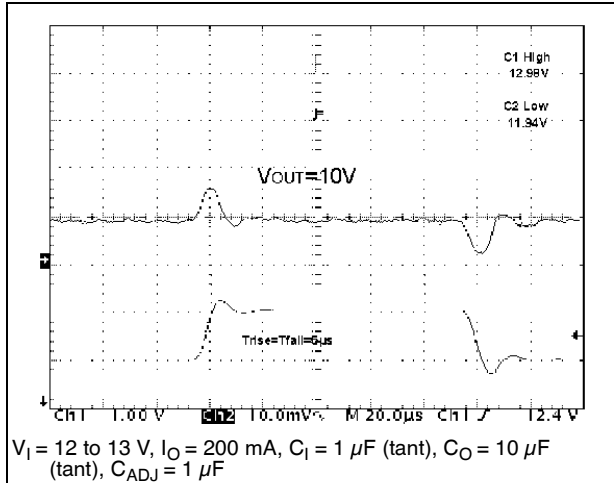


Figure 27. Load transient

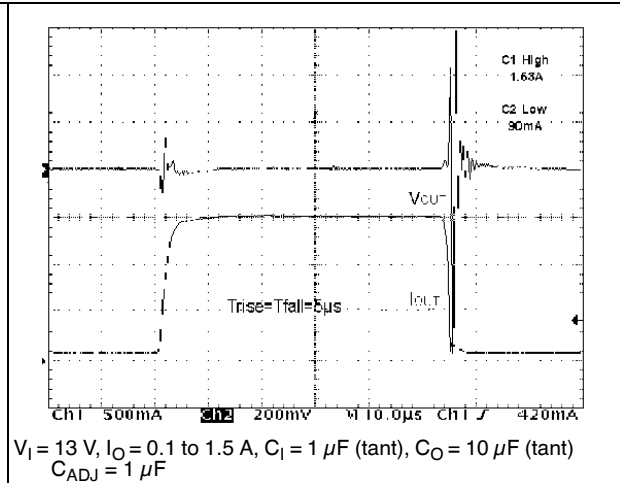


Figure 28. Load transient ($T_{rise} = T_{fall} = 10 \mu s$)

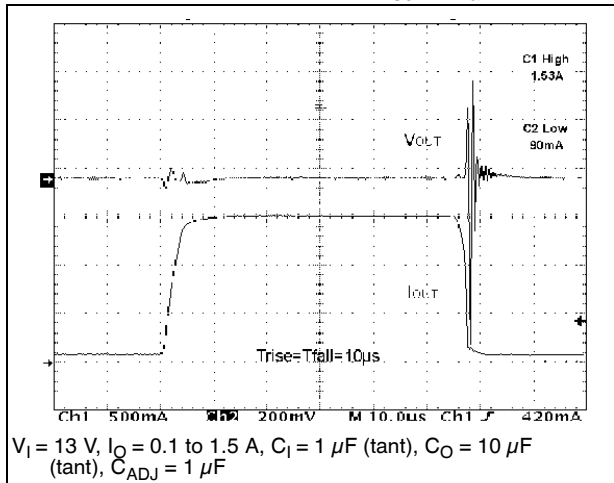
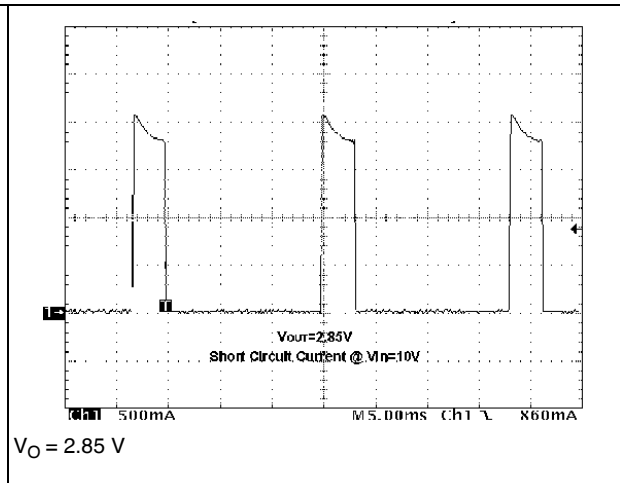


Figure 29. Thermal protection



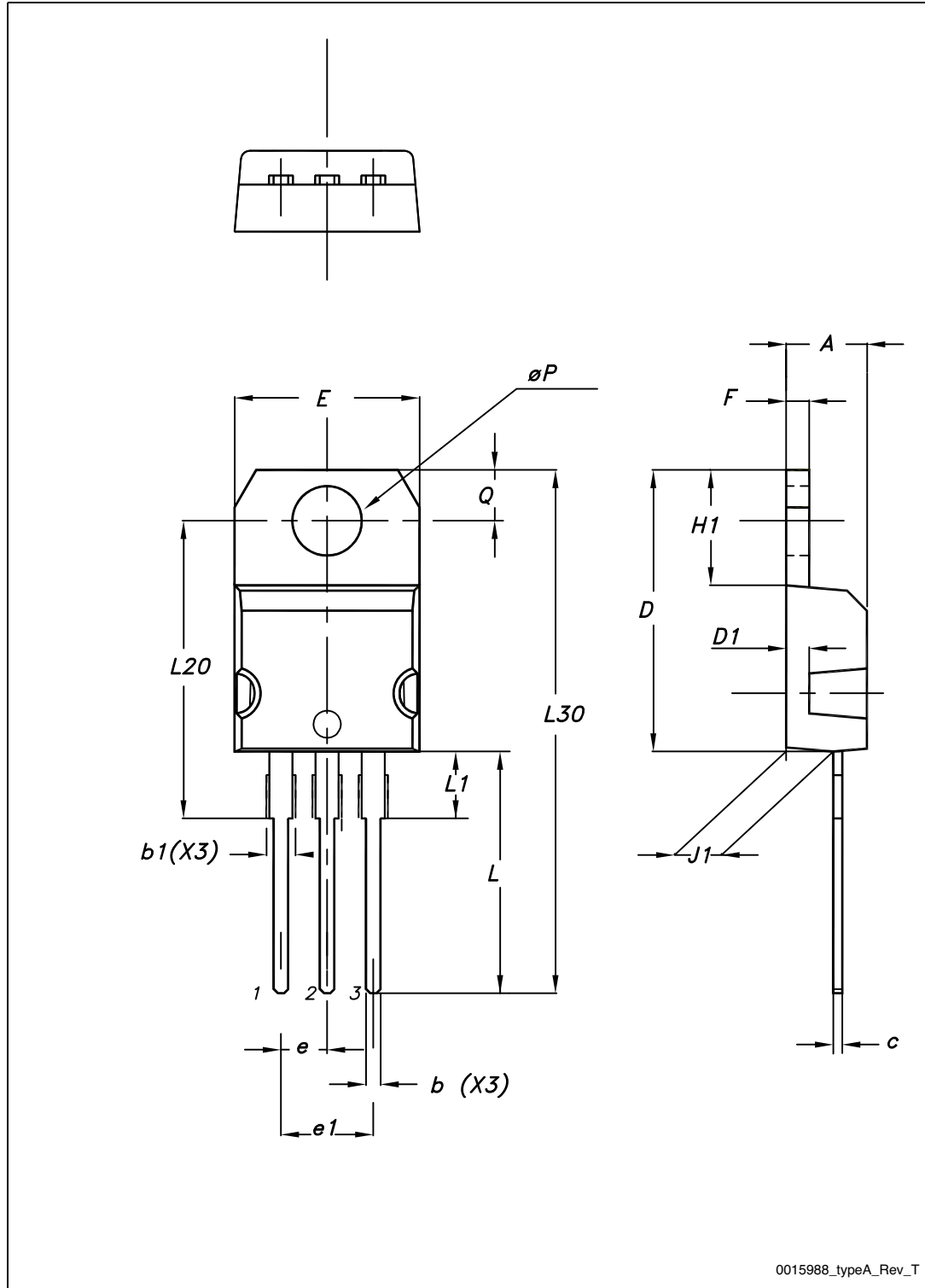
7 Package mechanical data

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.

Table 13. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

Figure 30. TO-220 type A drawing



0015988_typeA_Rev_T

Table 14. TO-220 SG (single gauge) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	0.51		0.60
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

Table 15. DPAK mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
(L1)		2.80	
L2		0.80	
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 32. DPAK drawing

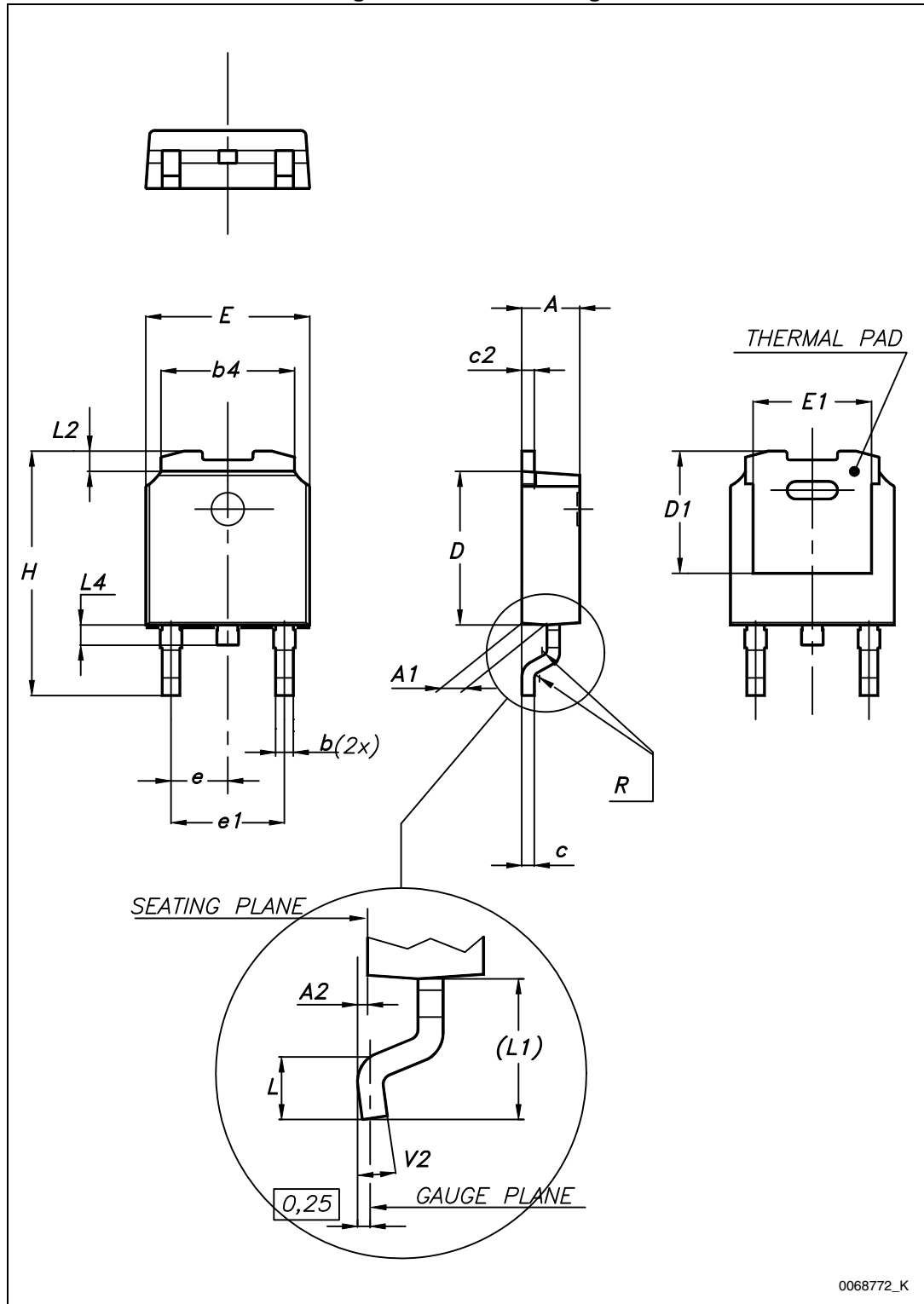
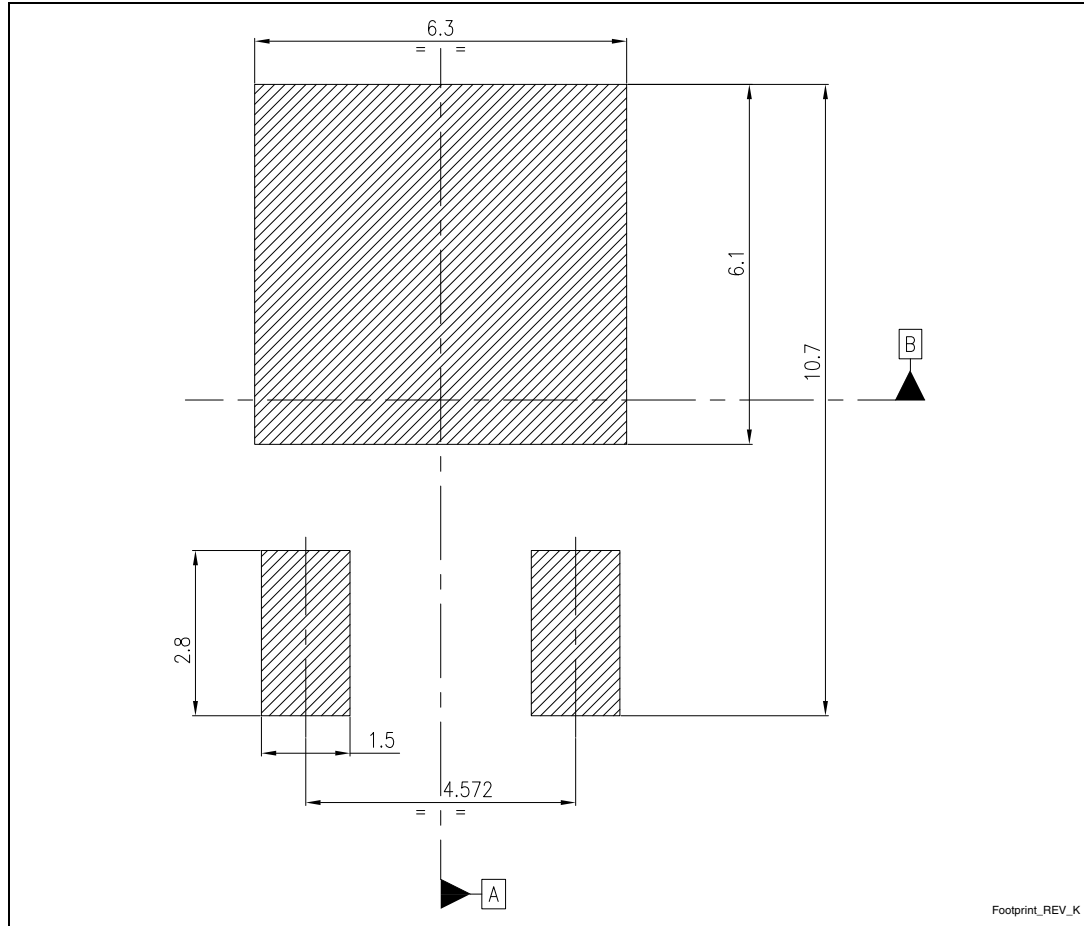


Figure 33. DPAK footprint (a)

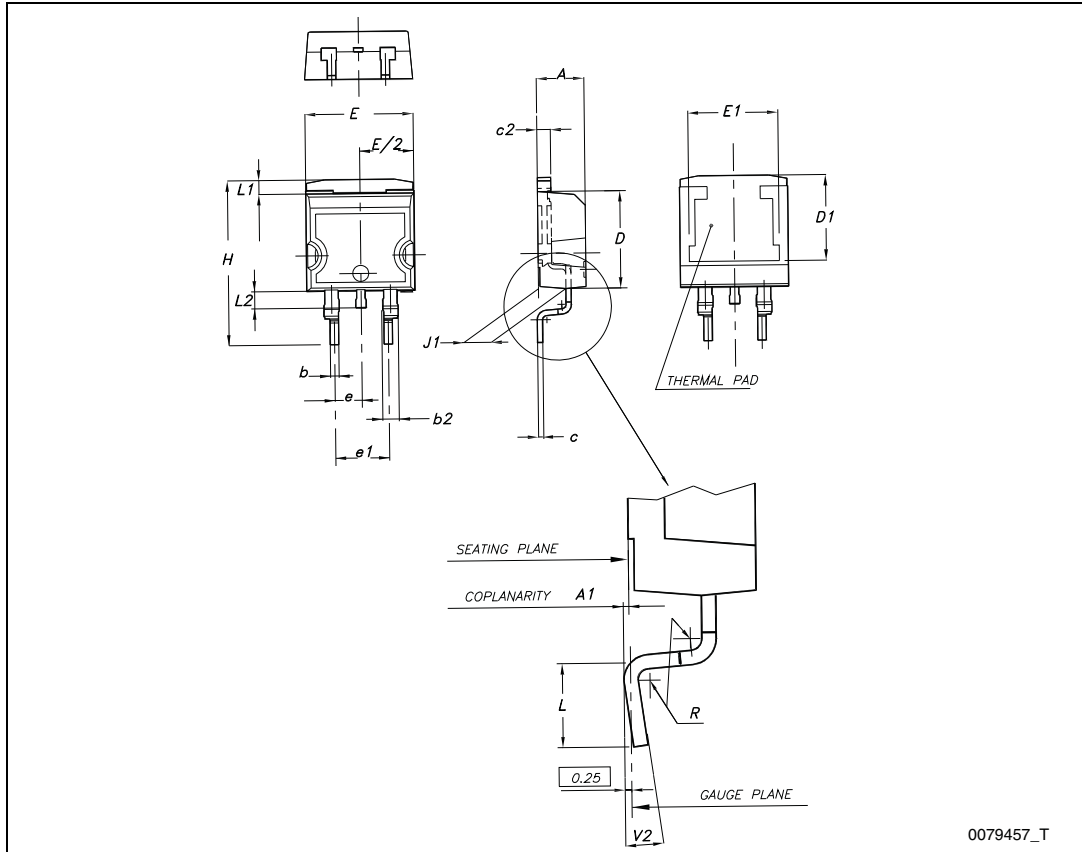


a. All dimensions are in millimeters

Table 16. D²PAK (SMD 2L STD-ST) type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50		
E	10		10.40
E1	8.50		
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 34. D²PAK (SMD 2L STD-ST) type A drawing

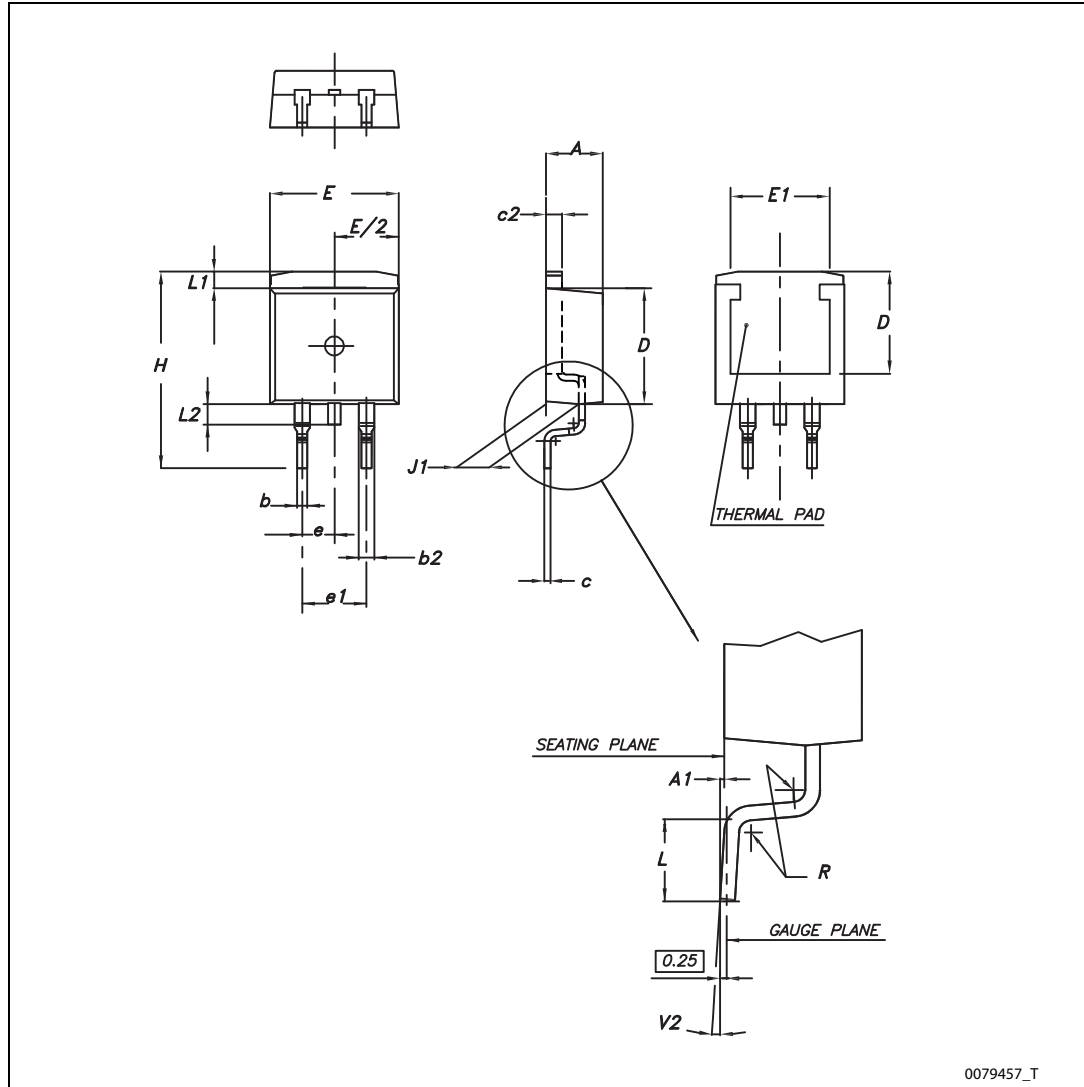


0079457_T

Table 17. D²PAK (SMD 2L Wooseok-subcon.) type C mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.70
A1	0		0.20
b	0.70		0.90
b2	1.17		1.37
c	0.45	0.50	0.60
c2	1.25	1.30	1.40
D	9	9.20	9.40
D1	7.50		
E	10		10.40
E1	8.50		
e		2.54	
e1	4.88		5.08
H	15		15.30
J1	2.20		2.60
L	1.79		2.79
L1	1		1.40
L2	1.20		1.60
R		0.30	
V2	0°		3°

Figure 35. D²PAK (SMD 2L Wooseok-subcon.) type C drawing



0079457_T

Figure 36. D²PAK (SMD 2L) footprint recommended

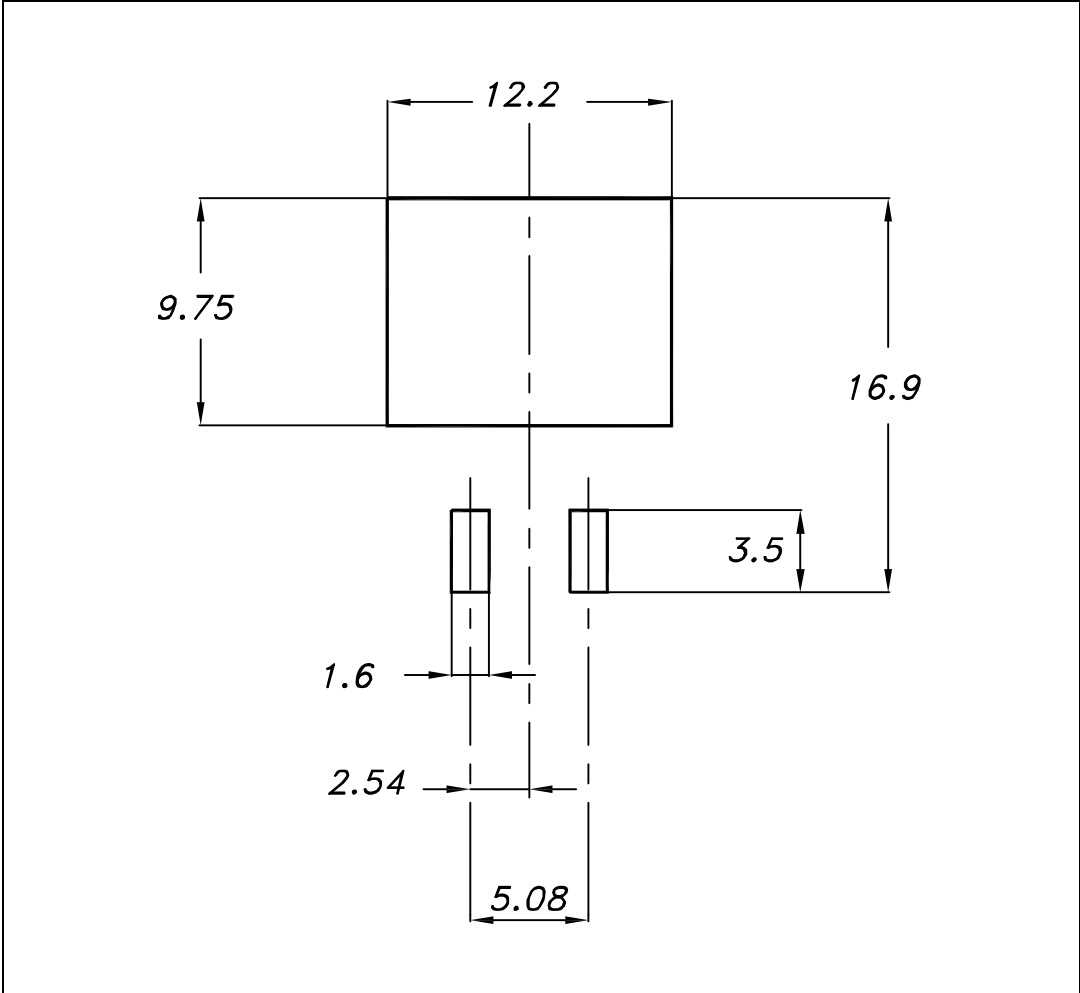


Table 18. DFN8L (4x4 mm.) mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
A	0.80	0.90	1
A1	0	0.02	0.05
A3		0,20	
b	0.23	0.30	0.38
D	3.90	4	4.10
D2	2.82	3	3.23
E	3.90	4	4.10
E2	2.05	2.20	2.30
e		0.80	
L	0.40	0.50	0.60

Figure 37. DFN8L package outline

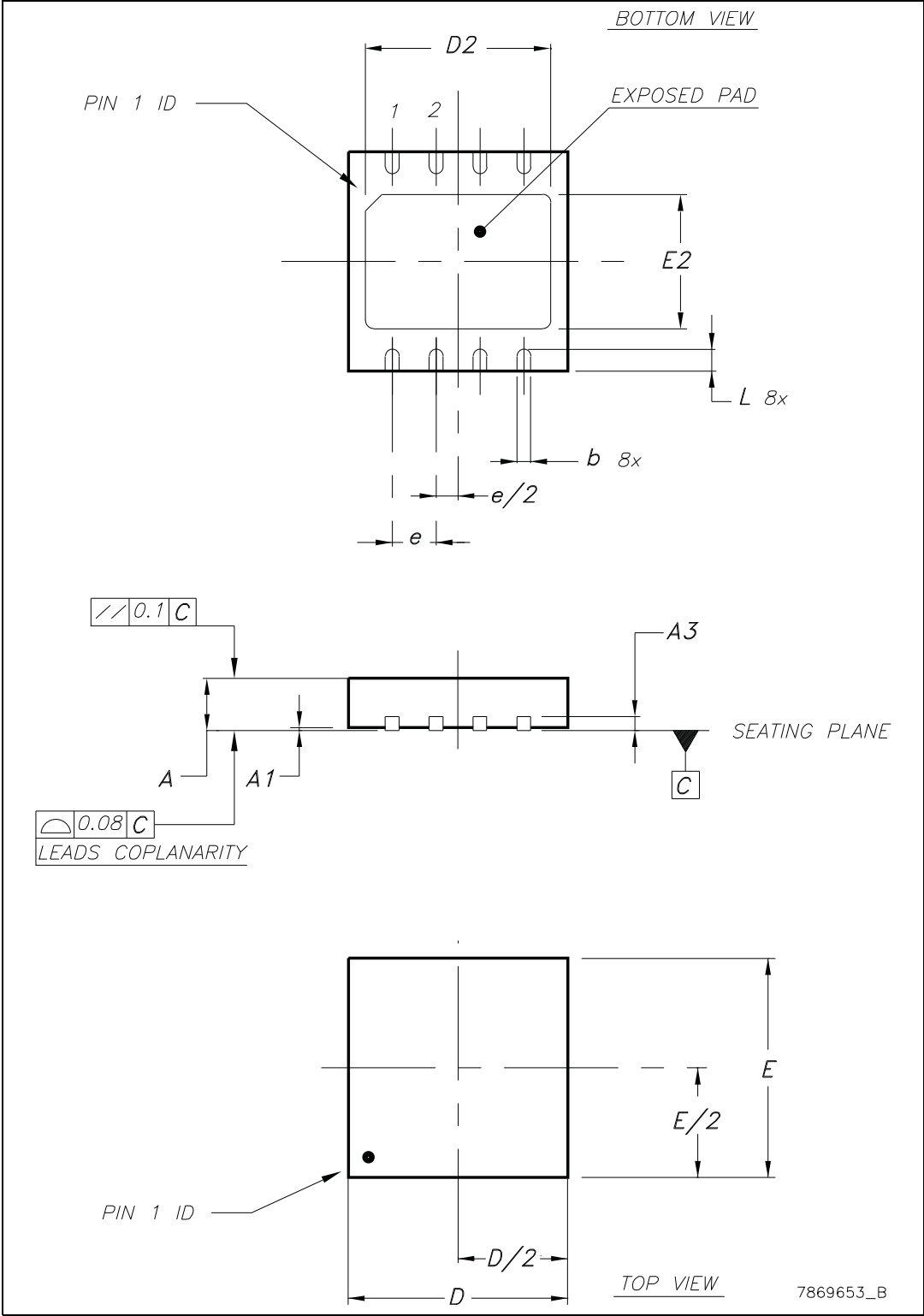


Figure 38. DFN8L footprint recommended

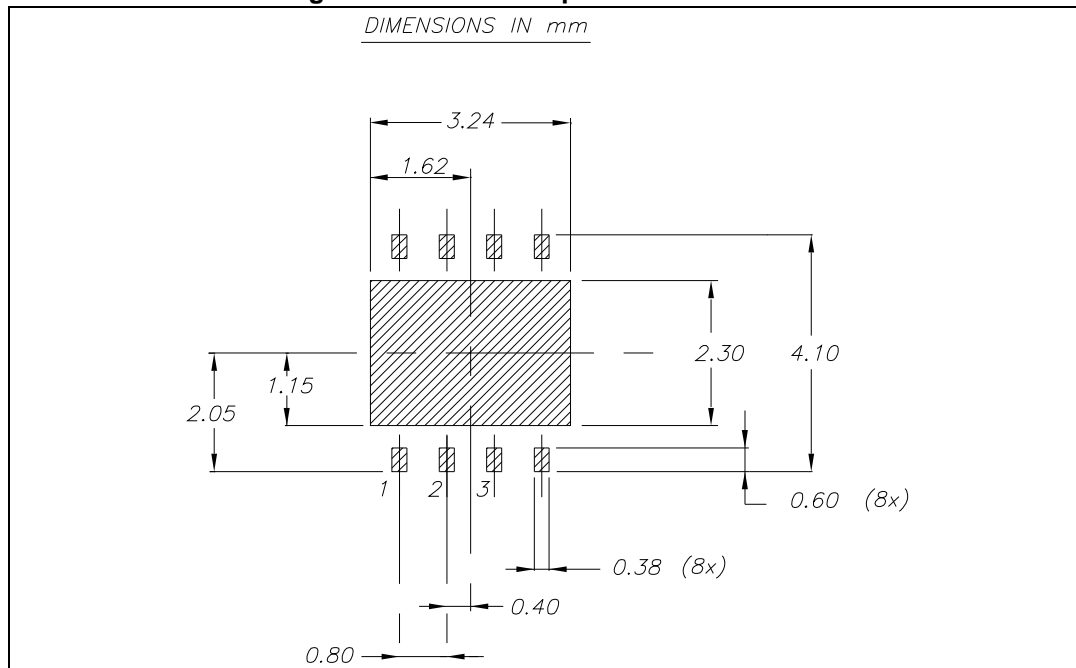


Table 19. D²PAK (SMD 3L STD-ST) type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50		
E	10		10.40
E1	8.50		
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
R		0.4	
V2	0°		8°

Figure 39.D²PAK (SMD 3L STD-ST) type A mechanical data

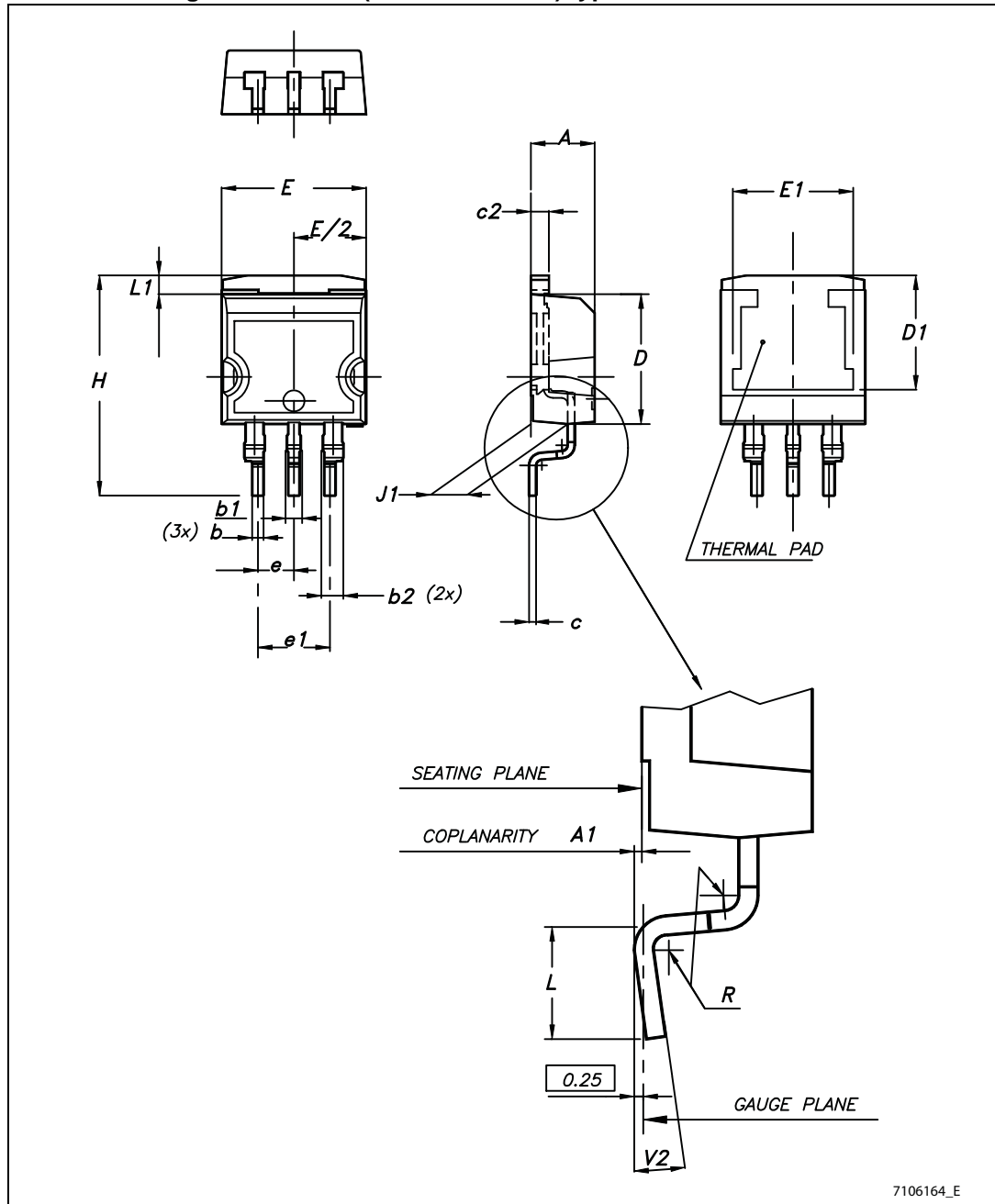
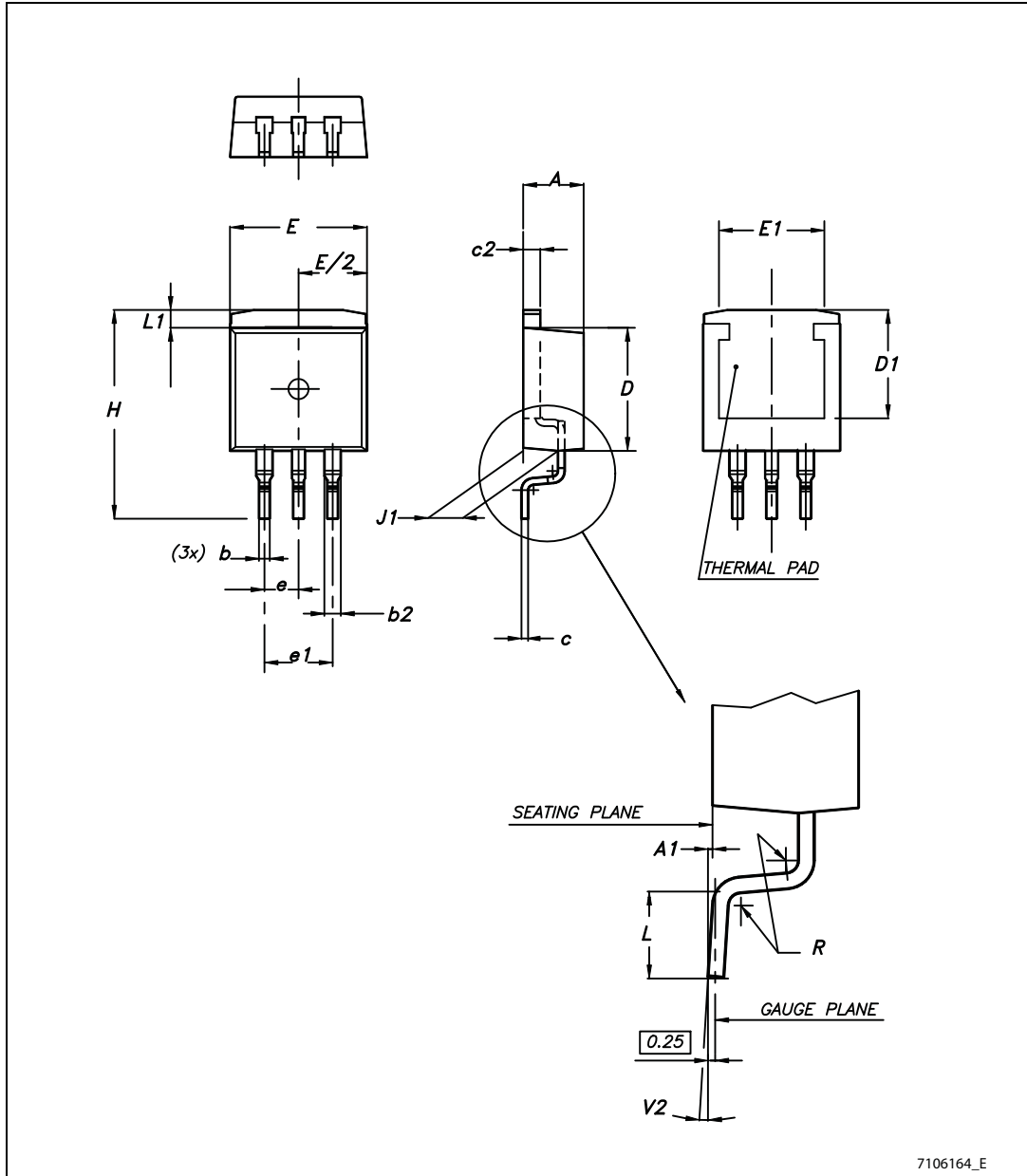


Table 20. D²PAK (SMD 3L Wooseok-subcon.) type B mechanical data

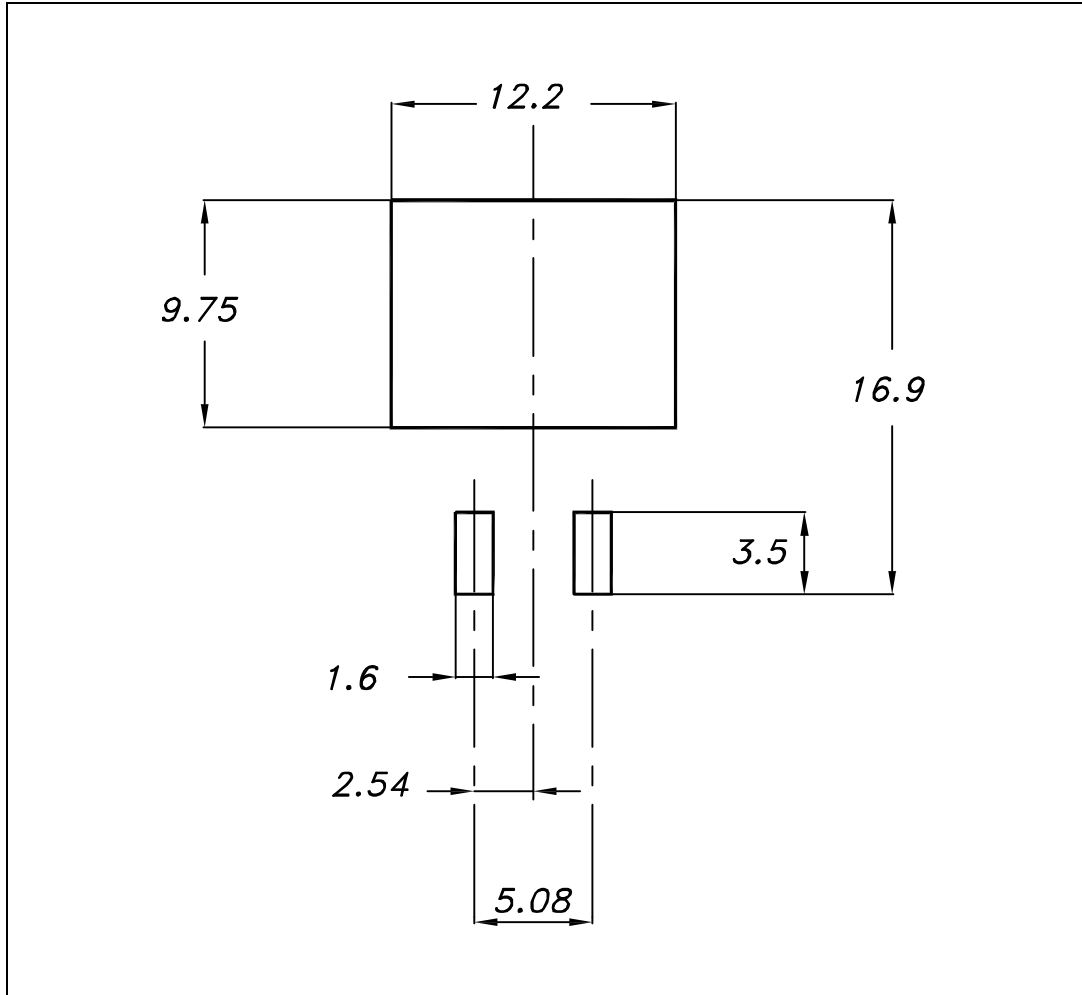
Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.70
A1	0		0.20
b	0.70		0.90
b2	1.17		1.37
c	0.45	0.50	0.60
c2	1.25	1.30	1.40
D	9	9.20	9.40
D1	7.50		
E	9.80		10.20
E1	7.50		
e		2.54	
e1		5.08	5.08
H	15	15.30	15.60
J1	2.20		2.60
L	1.79		2.79
L1	1		1.40
R		0.30	
V2	0°		3°

Figure 40. D²PAK (SMD 3L Wooseok-subcon.) type B drawing



7106164_E

Figure 41. D²PAK (SMD 3L) footprint recommended



8 Packaging mechanical data

Table 21.DPAK and D²PAK tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

Figure 42. Tape for DPAK and D²PAK

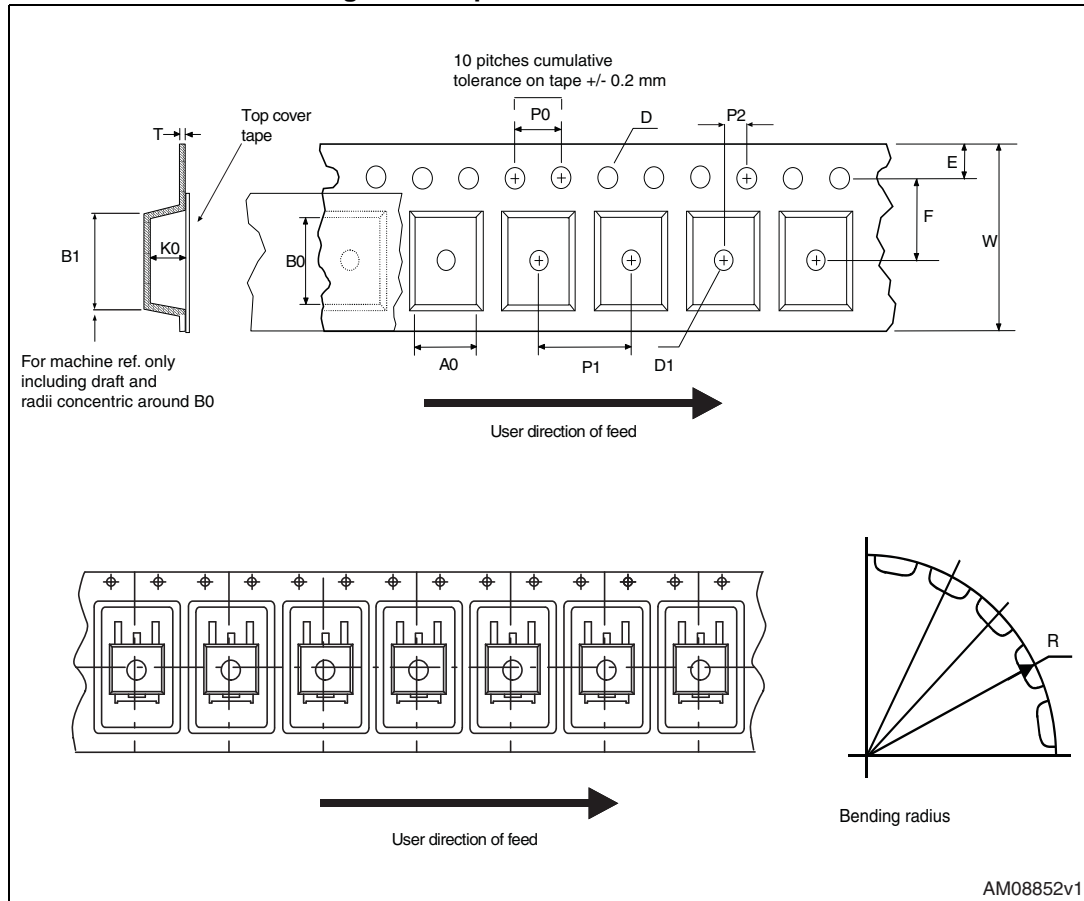


Figure 43. Reel for DPAK and D²PAK

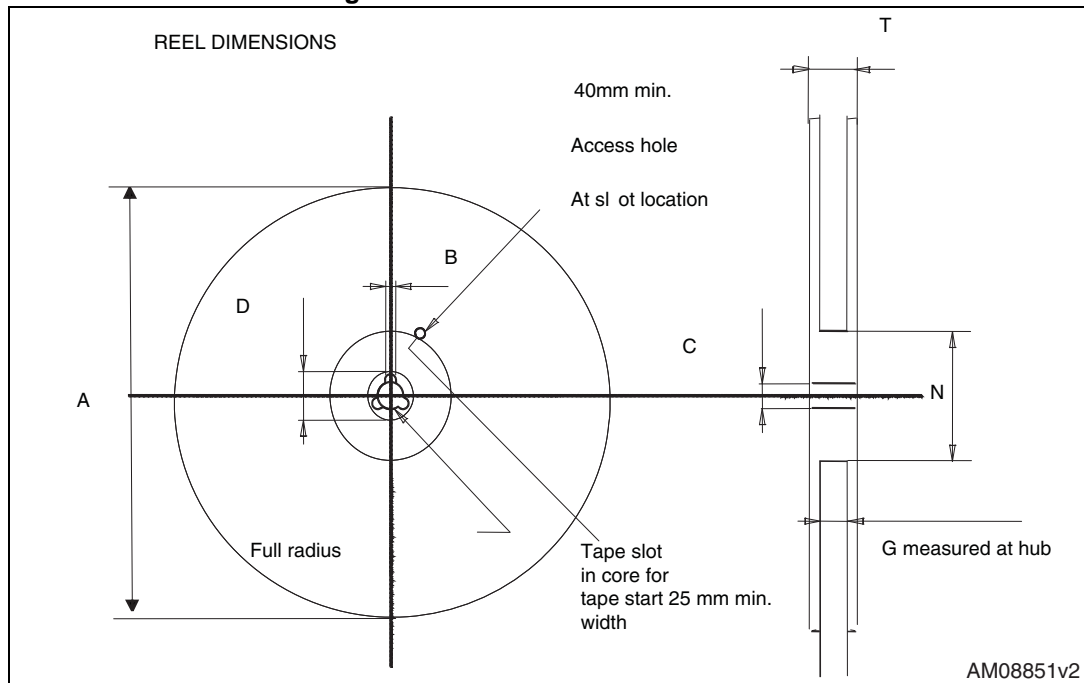


Table 22. Reel DFN8L dimensions

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

Figure 44. DFN8L carrier tape (dimension are in mm.)

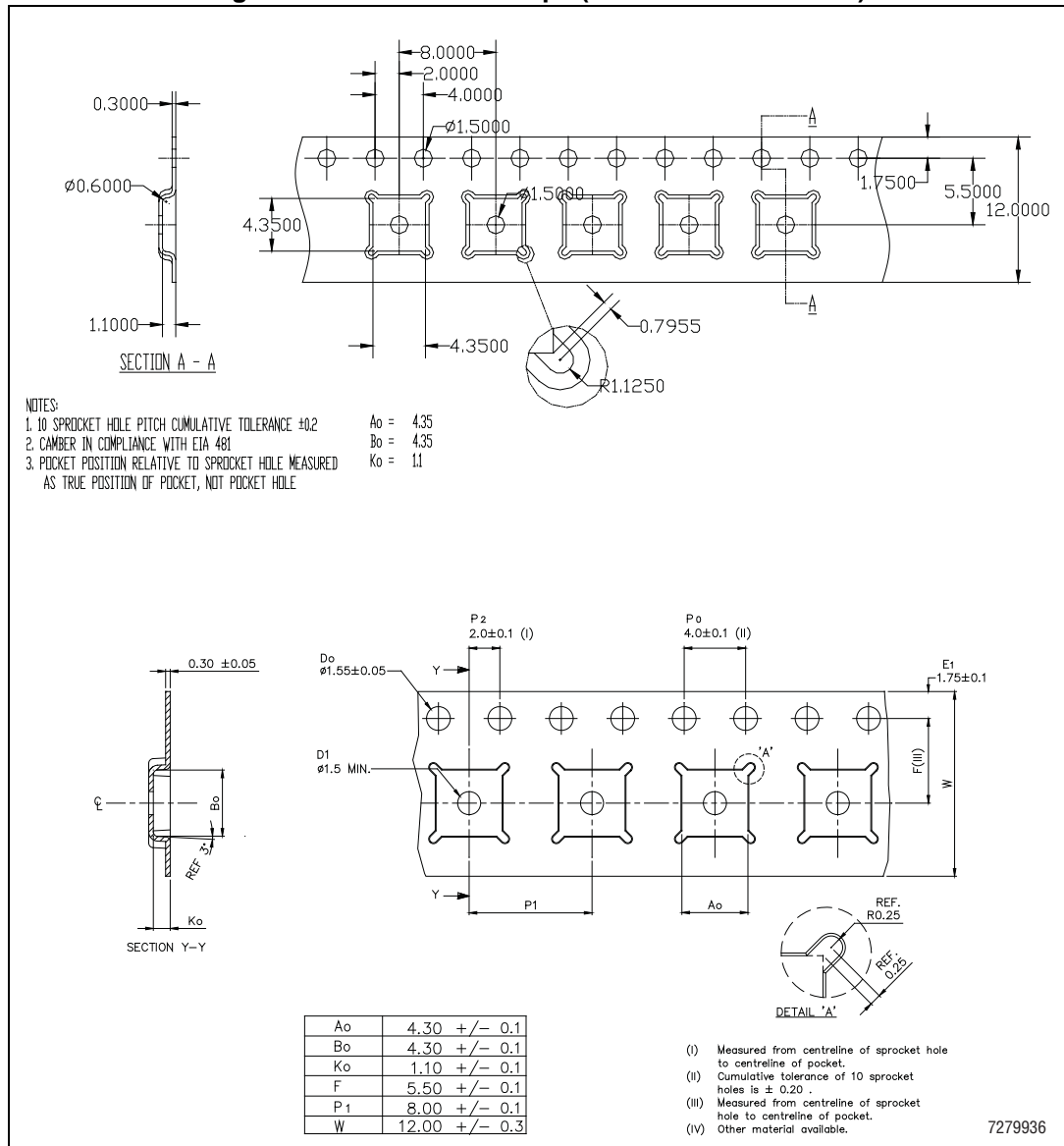
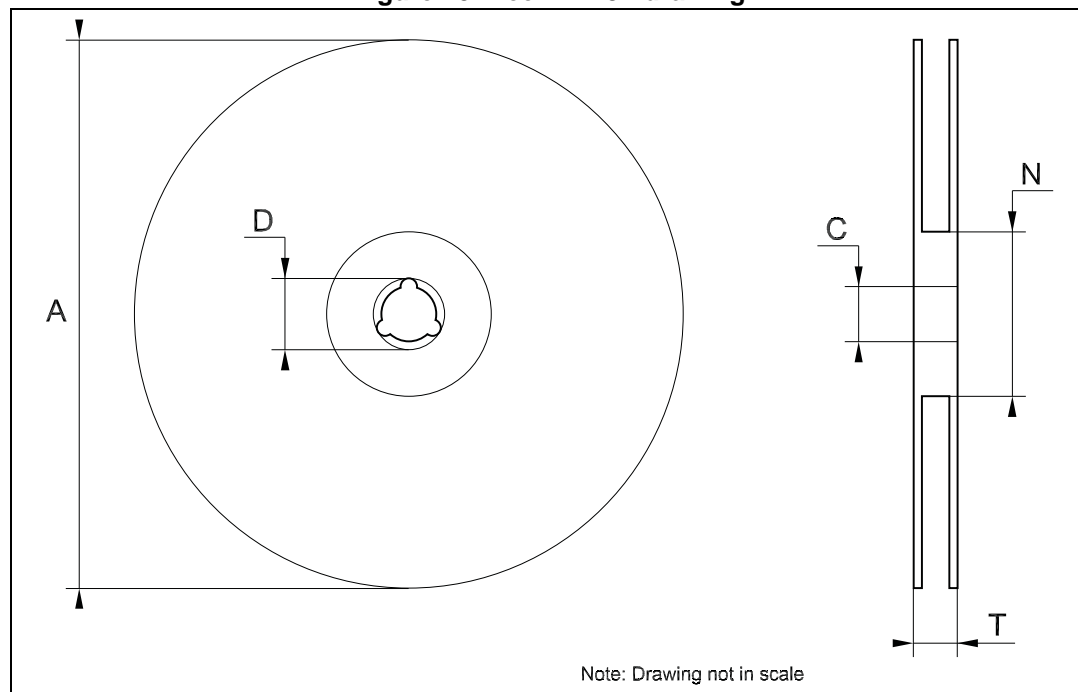


Figure 45. Reel DFN8L drawing



9 Order codes

Table 23. Order codes

Packages					
TO-220	D ² PAK	D ² PAK/A	DPAK	DFN8	Output voltages
LD1086V18	LD1086D2T18TR		LD1086DT18TR		1.8 V
			LD1086DT25TR		2.5 V
LD1086V33	LD1086D2T33TR	LD1086D2M33TR	LD1086DT33TR		3.3 V
	LD1086D2T50TR		LD1086DT50TR		5.0 V
	LD1086D2T12TR				12.0 V
LD1086V	LD1086D2TTR	LD1086D2MTR	LD1086DTTR	LD1086PUR	ADJ
LD1086V-DG ⁽¹⁾					ADJ
LD1086VY ⁽²⁾			LD1086DTTRY ⁽²⁾		ADJ
	LD1086BD2TTR		LD1086BDTTR		

1. TO-220 dual gauge frame.
2. Automotive grade products.

10 Revision history

Table 24. Document revision history

Date	Revision	Changes
16-May-2006	14	Order codes updated and new template.
19-Jan-2007	15	D ² PAK mechanical data updated and add footprint data.
05-Apr-2007	16	Order codes updated.
07-Jun-2007	17	Order codes updated.
19-Jul-2007	18	Add note on Figure 2 .
03-Dec-2007	19	Modified: Table 23 .
31-Jan-2008	20	Added new order codes for Automotive grade products.
18-Feb-2008	21	Modified: Table 23 on page 47 .
14-Jul-2008	22	Modified: Table 1 on page 1 and Table 23 on page 47 .
10-Mar-2010	23	Added: Table 12 on page 22 , Figure 30 on page 23 , Figure 31 on page 24 , Figure 32 and Figure 33 on page 25 .
15-Nov-2010	24	Modified: R_{thJC} value for TO-220 Table 3 on page 7 .
11-Jul-2011	25	Modified: Figure 24 , Figure 25 on page 21 and Table 23 on page 47 .
10-Feb-2012	26	Added: order code LD1086V-DG Table 23 on page 47 .
15-Mar-2012	27	Added: new order code LD1086PUR Table 23 on page 47 and new package mechanical data DFN8 (4x4 mm) Table 18 on page 35 , Figure 37 on page 36 , Figure 38 on page 37 , Figure 44 on page 45 and Figure 45 on page 46 .
19-Oct-2012	28	Added: R_{thJA} value for DPAK Table 3 on page 7 .
13-Feb-2013	29	Modified: Output voltage in Voltage reference parameter Table 10 on page 15 and Table 12 on page 17 .
01-Mar-2013	30	Modified: DFN8 (4 x 4) pin configuration Figure 2 on page 6 .
17-Jun-2013	31	Added Table 10: Electrical characteristics of LD1086B# and Section 8: Packaging mechanical data . Updated Section 7: Package mechanical data and Table 23: Order codes . Minor text changes.

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

ST PRODUCTS ARE NOT AUTHORIZED FOR USE IN WEAPONS. NOR ARE ST PRODUCTS DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER'S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR "AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL" INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2013 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com

