

## 7 A very low drop positive voltage regulator adjustable

### Features

- Output current limit
- Low dropout voltage: typically 400 mV at 7 A output current
- Output voltage remote sense pin
- Fast transient response
- Thermal shutdown protection with hysteresis
- Wide operating temperature range -40 °C to 125 °C
- No supply sequencing problems in dual supply mode
- Output voltages available: adjustable

### Description

The LD1580 is a very low dropout positive linear voltage regulator particularly suitable in applications requiring output currents up to 7 A.

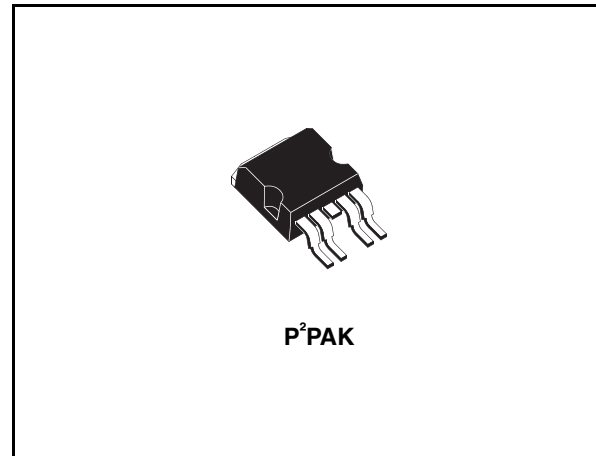
The LD1580 typical dropout voltage is 400 mV at 7 A while it decreases at lighter loads.

This very low dropout is achieved thanks to a second input voltage pin, named VCONTROL, which is also responsible of the output power stage driving.

The LD1580 is provided with an output voltage remote sense pin which reduces dramatically any output voltage variations that could occur due to load changes.

The ADJ pin is still available. A small capacitor on this pin helps to improve transient response.

The LD1580 also features a built-in output current limit function and a thermal shutdown protection with hysteresis which prevents from excessive



power dissipation in case of insufficient heatsinking. On chip trimming allows the regulator to reach a very tight output voltage tolerance, within  $\pm 2\%$  at the maximum output current and over the full temperature range.

**Table 1. Device summary**

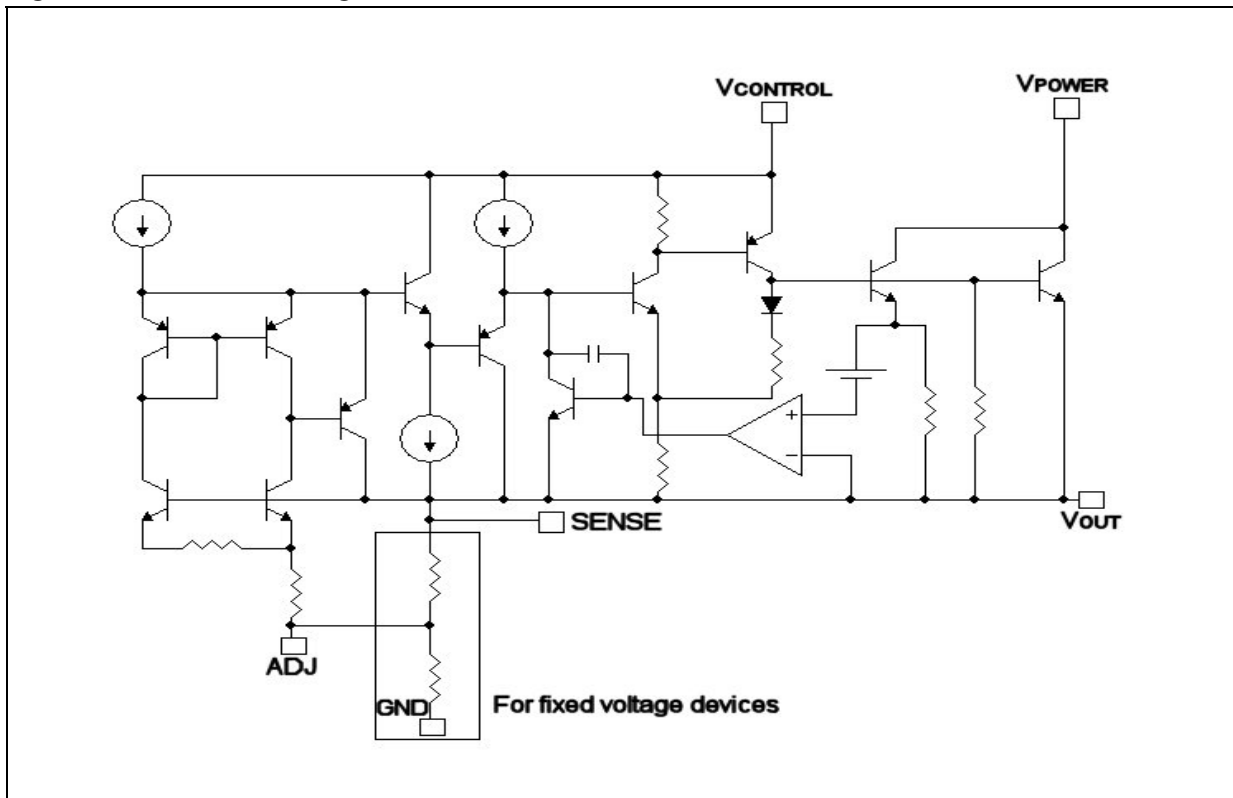
Part number	Order code	Packaging
LD1580XX	LD1580P2T-R	tape and reel

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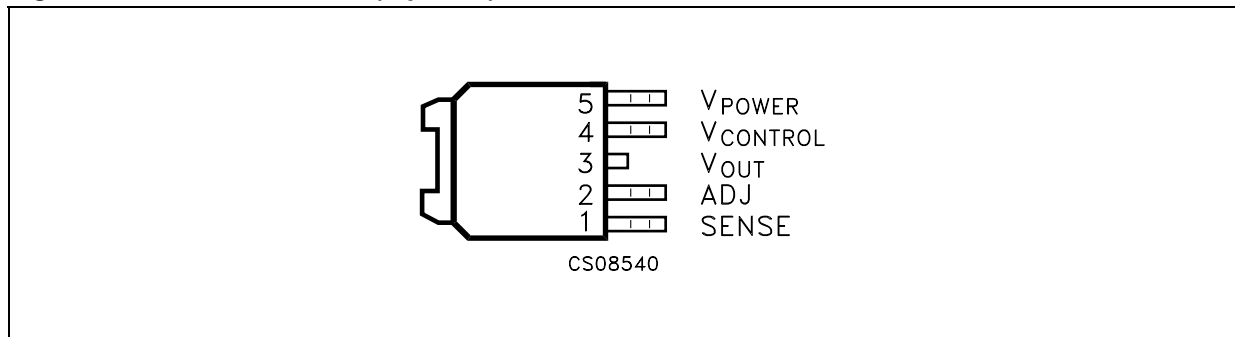
# 1 Diagram

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
$V_{POWER}$	DC $V_{POWER}$ voltage	from -0.3 to 6	V
$V_{CONTROL}$	DC $V_{CONTROL}$ voltage	from -0.3 to 13	V
$I_{OUT}$	Output current	Internally limited	
$P_D$	Power dissipation	Internally limited	
$T_{STG}$	Storage temperature range	-55 to +150	°C
$T_{OP}$	Operating junction temperature range	-40 to +125	°C

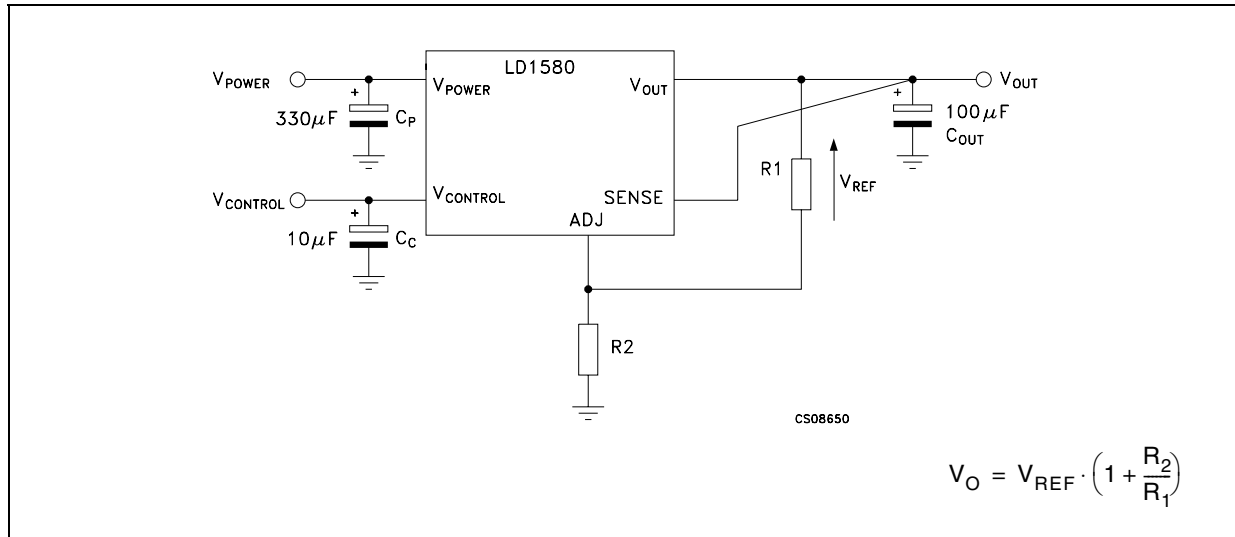
*Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.*

**Table 3. Thermal data**

Symbol	Parameter	P <sup>2</sup> PAK	Unit
$R_{thJC}$	Thermal resistance junction-case	3	°C/W
$R_{thJA}$	Thermal resistance junction-ambient	62.5	°C/W

# 4 Typical application

Figure 3. Typical application circuits



## 5 Electrical characteristics

**Table 4. Electrical characteristics for LD1580** ( $T_J = -40\text{ °C}$  to  $125\text{ °C}$ ,  $C_P = 330\text{ }\mu\text{F}$ ,  $C_C = 10\text{ }\mu\text{F}$ ,  $C_{OUT} = 100\text{ }\mu\text{F}$ , unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$V_{CONTROL}=2.75\text{ V}$ , $V_{POWER}=2\text{ V}$ $T_J=25\text{ °C}$ , $I_{OUT}=10\text{ mA}$	1.237	1.250	1.263	V
		$V_{CONTROL}=2.7\text{ V}$ to $12\text{ V}$ $V_{POWER}=2.05\text{ V}$ to $5.5\text{ V}$ , $I_{OUT}=0.01$ to $7\text{ A}$	1.225	1.250	1.275	
$\Delta V_O$	Line regulation	$V_{CONTROL}=2.5\text{ V}$ to $12\text{ V}$ $V_{POWER}=1.75\text{ V}$ to $5.5\text{ V}$ , $I_{OUT}=10\text{ mA}$		0.08	0.24	%
$\Delta V_O$	Load regulation	$V_{CONTROL}=2.75\text{ V}$ , $V_{POWER}=2.1\text{ V}$ $I_{OUT}=0.01$ to $7\text{ A}$		0.08	0.4	%
$I_C$	$V_{CONTROL}$ pin current	$V_{CONTROL}=2.75\text{ V}$ , $V_{POWER}=2.05\text{ V}$ $I_{OUT}=100\text{ mA}$		6	10	mA
		$V_{CONTROL}=2.75\text{ V}$ , $V_{POWER}=2.05\text{ V}$ $I_{OUT}=4\text{ A}$		30	60	
		$V_{CONTROL}=2.75\text{ V}$ , $V_{POWER}=1.75\text{ V}$ $I_{OUT}=4\text{ A}$		33	70	
		$V_{CONTROL}=2.75\text{ V}$ , $V_{POWER}=2.05\text{ V}$ $I_{OUT}=7\text{ A}$		60	120	
$I_{ADJ}$	Adjust pin current	$V_{CONTROL}=2.75\text{ V}$ , $V_{POWER}=2.05\text{ V}$ $I_{OUT}=10\text{ mA}$		50	120	$\mu\text{A}$
$I_{OUT}$	Output current limit	$V_{CONTROL}=2.75\text{ V}$ , $V_{POWER}=2.05\text{ V}$ <sup>(1)</sup>	8	9		A
SVR	Supply voltage rejection	$V_{CONTROL}=V_{POWER}=3.75\text{ V Avg}$ $V_{RIPPLE}=1\text{ V}_{P-P}$ , $I_{OUT}=4\text{ A}$ , $T_J=25\text{ °C}$	61.5	81.5		dB
$V_{DC}$	Minimum $V_{CONTROL}$ voltage, ( $V_{CONTROL}-V_O$ )	$V_{POWER}=2.05\text{ V}$ , $I_{OUT}=100\text{ mA}$ <sup>(2)</sup>		0.95	1.15	V
		$V_{POWER}=2.05\text{ V}$ , $I_{OUT}=1\text{ A}$		0.95	1.15	
		$V_{POWER}=2.05\text{ V}$ , $I_{OUT}=4\text{ A}$		1	1.2	
		$V_{POWER}=2.05\text{ V}$ , $I_{OUT}=7\text{ A}$		1.05	1.3	
$V_{DP}$	Minimum $V_{POWER}$ voltage ( $V_{POWER}-V_O$ )	$V_{CONTROL}=2.75\text{ V}$ , $I_{OUT}=1\text{ A}$ <sup>(2)</sup>		0.05	0.15	V
		$V_{CONTROL}=2.75\text{ V}$ , $I_{OUT}=4\text{ A}$		0.2	0.4	
		$V_{CONTROL}=2.75\text{ V}$ , $I_{OUT}=7\text{ A}$		0.4	0.6	
$T_{SHDN}$	Shutdown temperature threshold			170		$^{\circ}\text{C}$
$T_{HYST}$	Thermal shutdown hysteresis			5		$^{\circ}\text{C}$

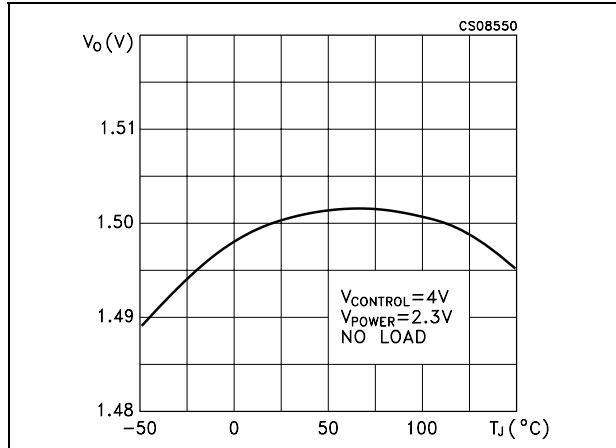
1. Measured when the  $V_{OUT}$  voltage drops below 100 mV with respect to its nominal value.

2. Measured when the  $V_{OUT}$  voltage drops below 2 % with respect to its nominal value.

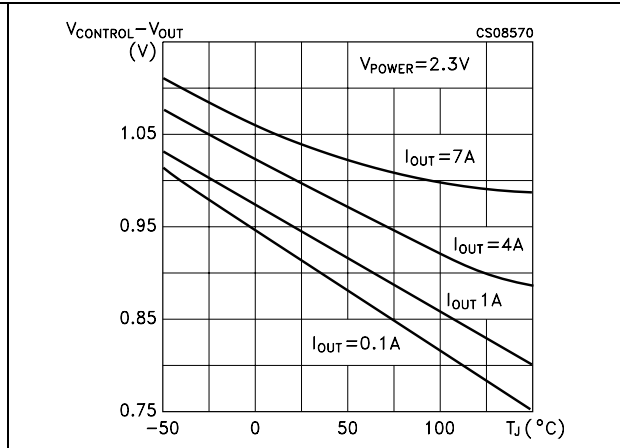
# 6 Typical characteristics

(unless otherwise specified  $T_J = 25\text{ }^\circ\text{C}$ ,  $C_P = 330\text{ }\mu\text{F}$ ,  $C_C = 10\text{ }\mu\text{F}$ ,  $C_{OUT} = 100\text{ }\mu\text{F}$ )

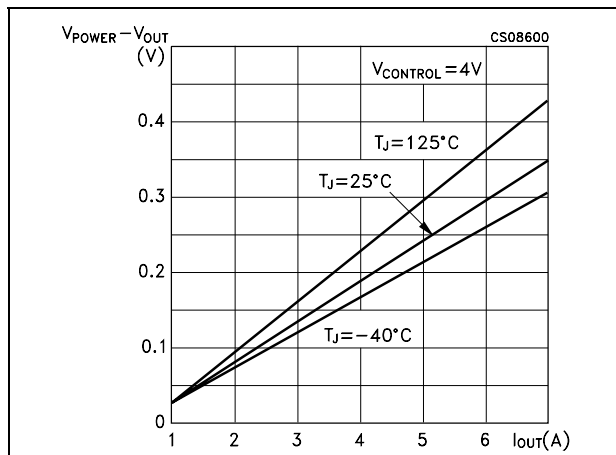
**Figure 4. Output voltage vs temperature**



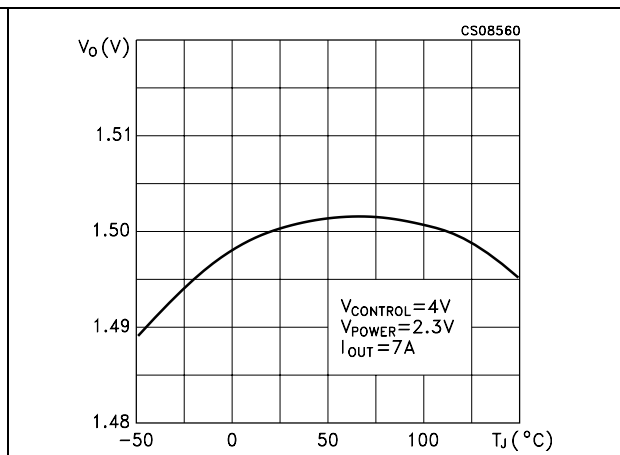
**Figure 5. Minimum VCONTROL voltage vs temperature**



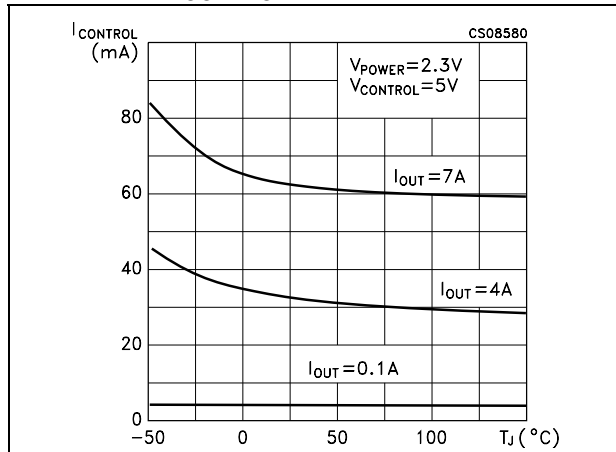
**Figure 6. Minimum VPOWER voltage vs output current**



**Figure 7. Output voltage vs temperature**



**Figure 8. VCONTROL pin current vs temp.**



**Figure 9. Minimum VPOWER voltage vs temp.**

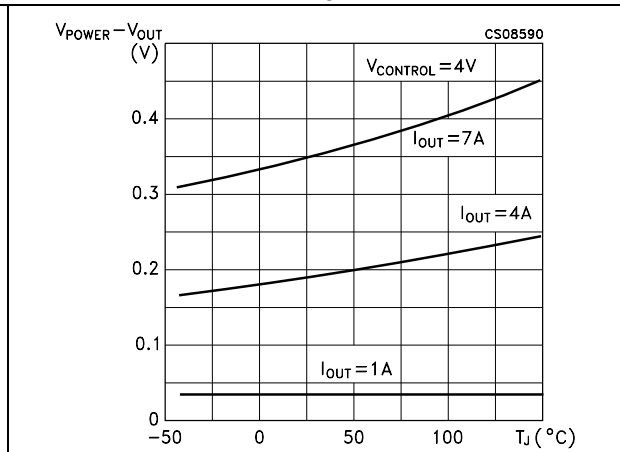




Figure 10.  $V_{CONTROL}$  pin current vs output current

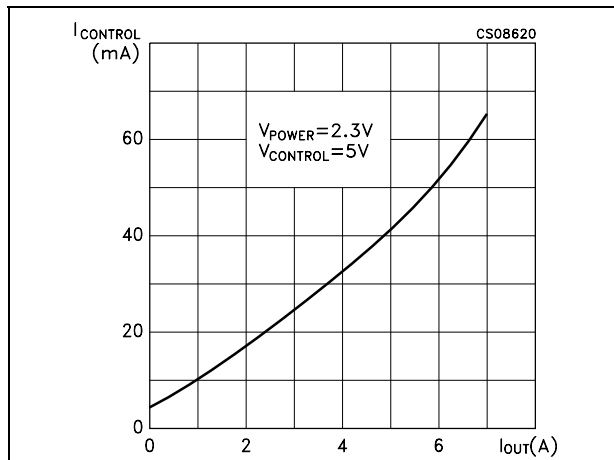


Figure 11. Output current limit vs temperature

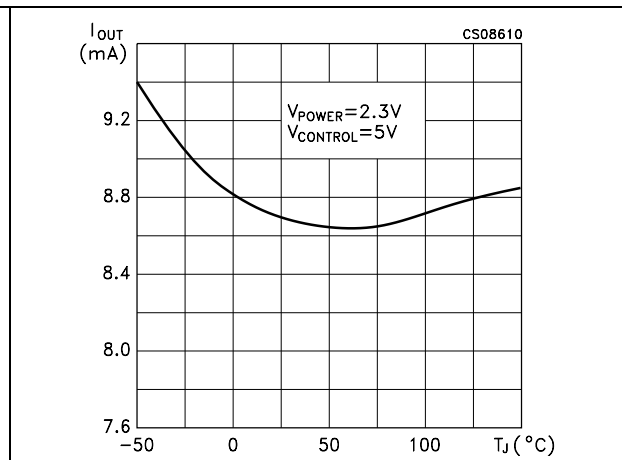


Figure 12. Quiescent current vs temperature

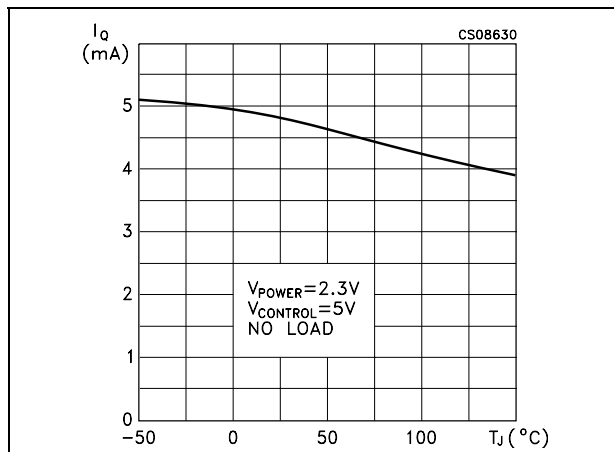


Figure 13. Supply voltage rejection vs output current

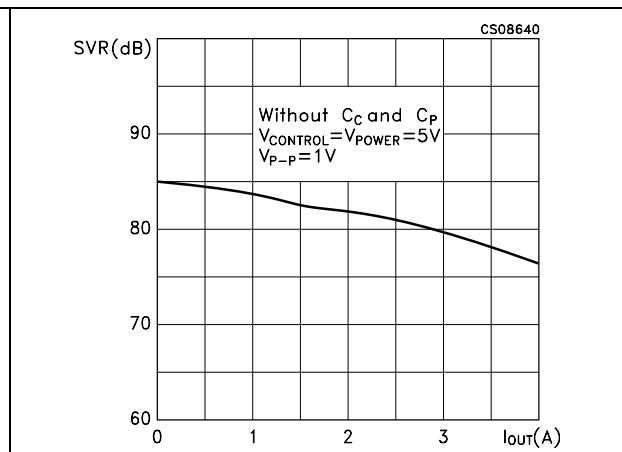


Figure 14. Line transient response

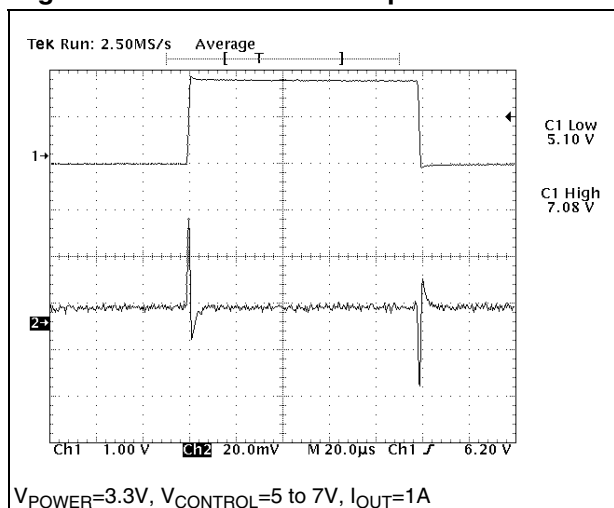


Figure 15. Line transient response

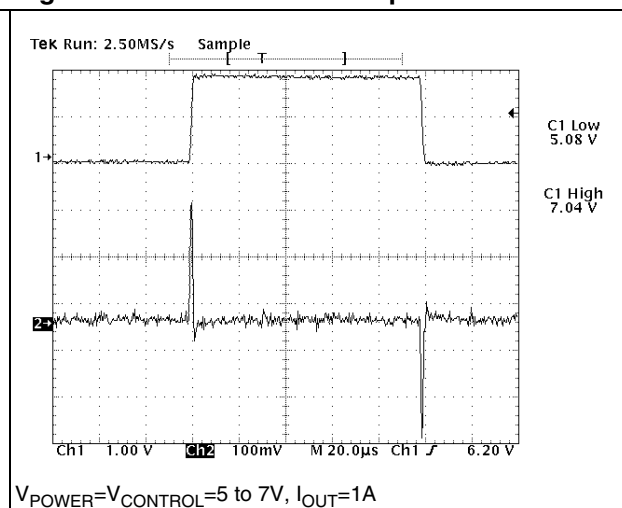


Figure 16. Load transient response

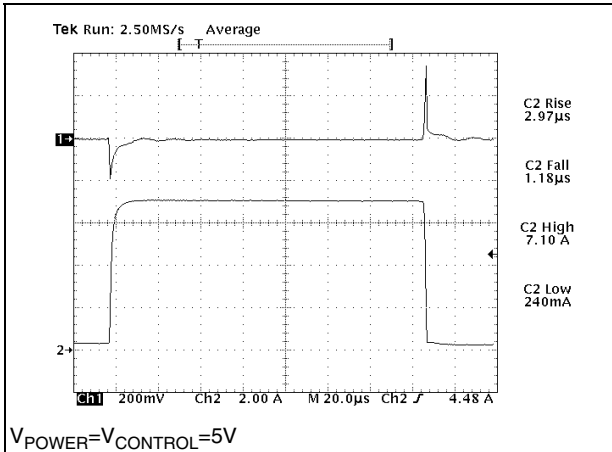


Figure 17. Load transient response

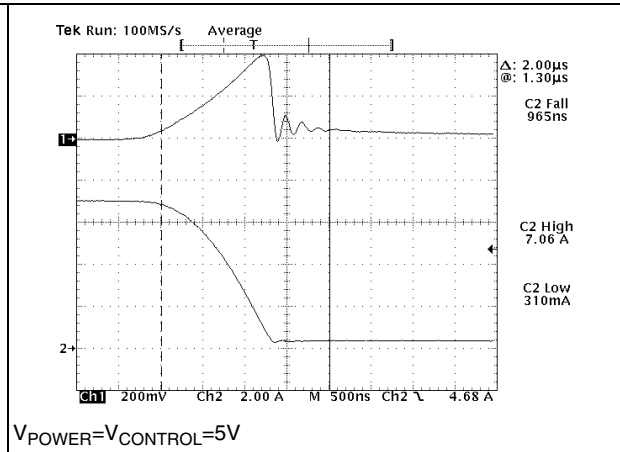
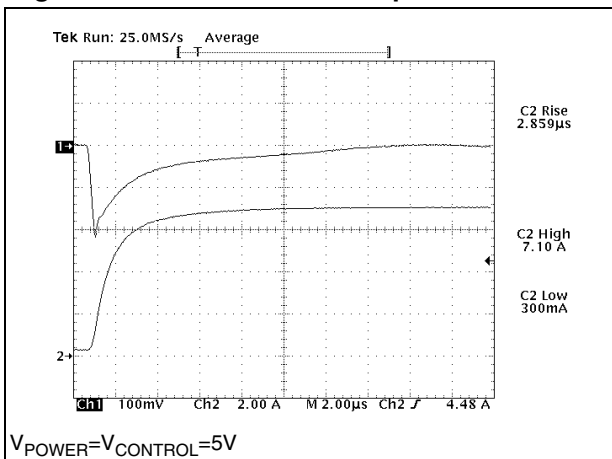


Figure 18. Load transient response

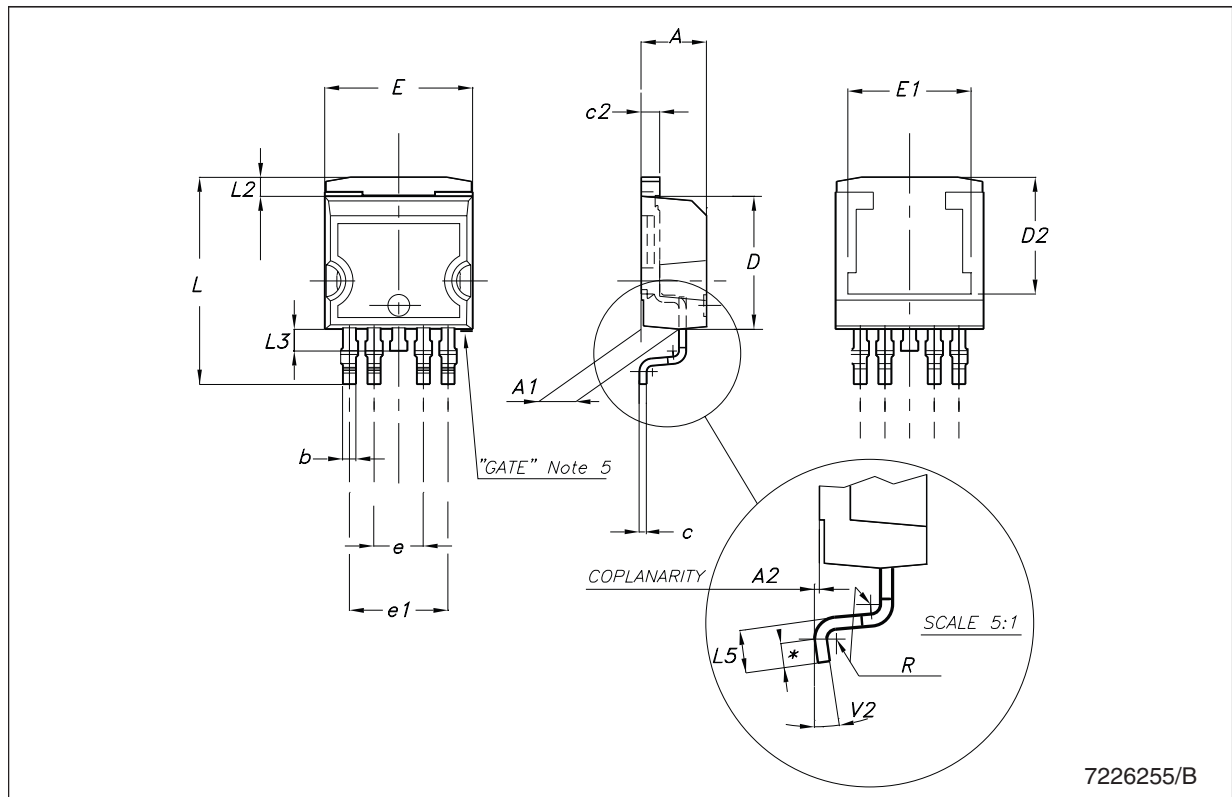


## 7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK<sup>®</sup> 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](http://www.st.com).

**P<sup>2</sup>PAK mechanical data**

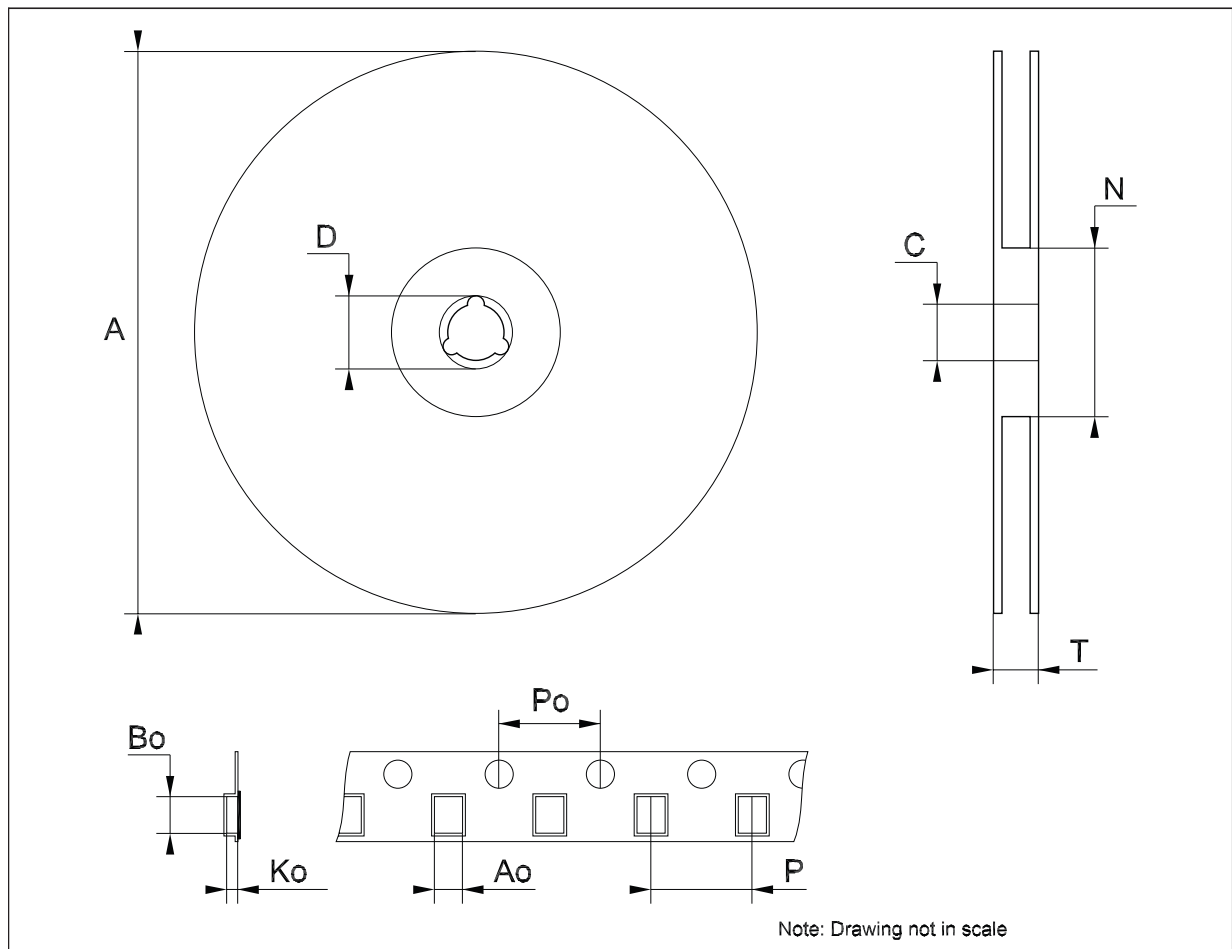
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.30		4.80	0.169		0.188
A1	2.40		2.80	0.094		0.110
A2	0.03		0.23	0.001		0.009
b	0.80		1.05	0.031		0.041
c	0.45		0.60	0.017		0.023
c2	1.17		1.37	0.046		0.053
D	8.95		9.35	0.352		0.368
D2		8			0.315	
E	10.00		10.40	0.393		0.409
E1		8.5			0.334	0.409
e	3.20		3.60	0.126		0.142
e1	6.60		7.00	0.260		0.275
L	13.70		14.50	0.539		0.571
L2	1.25		1.40	0.049		0.055
L3	0.90		1.70	0.035		0.067
L5	1.55		2.40	0.061		0.094
R		0.40			0.016	
V2	0°		8°	0°		8°



7226255/B

**Tape & reel D<sup>2</sup>PAK-P<sup>2</sup>PAK-D<sup>2</sup>PAK/A-P<sup>2</sup>PAK/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



## 8 Revision history

**Table 5. Document revision history**

Date	Revision	Changes
08-Sep-2005	3	Order codes updated.
09-May-2007	4	Order codes updated.
16-Apr-2008	5	Modified: <a href="#">Table 1 on page 1</a> .

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