

## Low noise and low drop voltage regulator with shutdown function

Datasheet - production data



### Features

- Output current up to 150 mA
- Low-dropout voltage (350 mV at  $I_{OUT} = 150$  mA)
- Very low quiescent current:
  - 0.1  $\mu$ A in OFF mode and max. 250  $\mu$ A in ON mode at  $I_{OUT} = 0$  mA
- Low output noise:
  - typ. 30  $\mu$ V at  $I_{OUT} = 60$  mA and  $10 \text{ Hz} < f < 80 \text{ kHz}$
- Wide range of output voltages

- Internal current and thermal limit
- Operative input voltage from:
  - $V_{OUT} + 0.5$  to 14 V (for  $V_{OUT} > 2$  V) or from 2.5 V to 14 V (for  $V_{OUT} < 2$  V)

### Description

The LK112 is a low-dropout linear regulator with a built-in electronic switch. The internal switch can be controlled by TTL or CMOS logic levels. The device is on-state when the control pin is pulled to a logic high level. An external capacitor can be connected to the noise bypass pin to reduce the output noise level to 30  $\mu$ Vrms. An internal PNP pass transistor is used to achieve a low-dropout voltage. The LK112 has a very low quiescent current in on mode while in off mode  $I_q$  is reduced below 100 nA max. The internal thermal shutdown circuitry limits the junction temperature below 150 °C. Load current is internally monitored and the device shuts down in the presence of a short-circuit or overcurrent condition on the output.

**Table 1. Device summary**

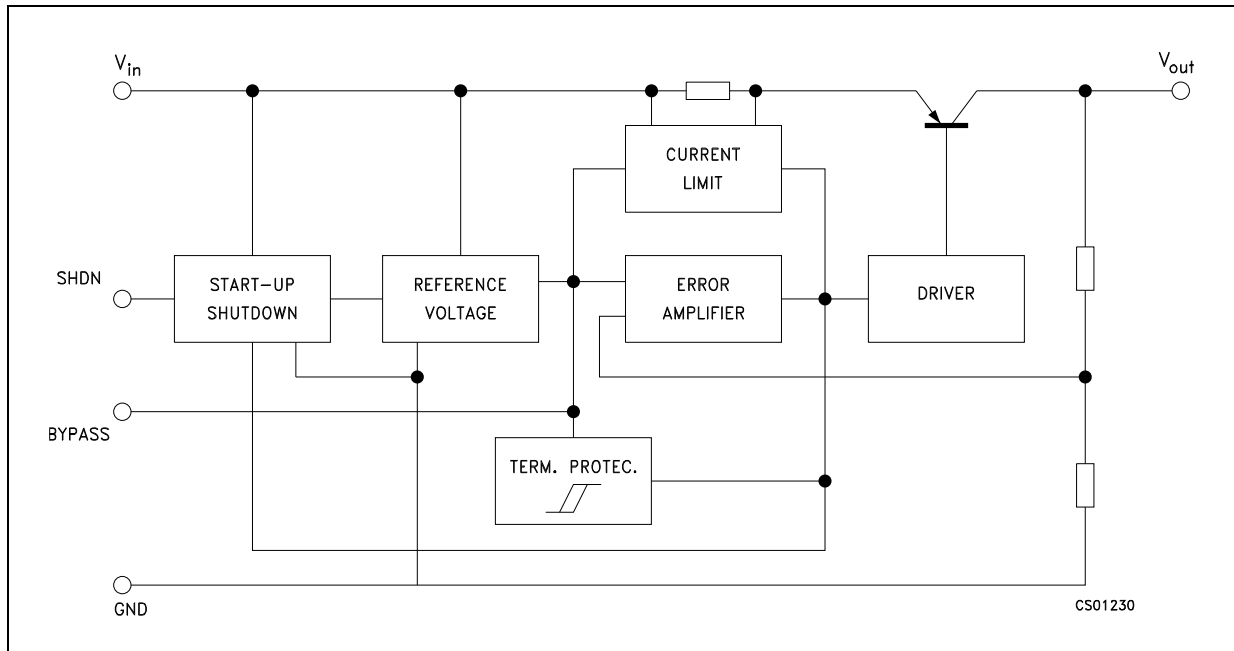
Order codes	Output voltages
LK112M15TR	1.5V
LK112M18TR	1.8V
LK112M25TR	2.5V
LK112M33TR	3.3V
LK112M50TR	5.0V
LK112M55TR	5.5V
LK112M60TR	6.0V
LK112M80TR	8.0V

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# 1 Diagram

Figure 1. Schematic diagram



## 2 Pin configuration

Figure 2. Pin connection (top view)

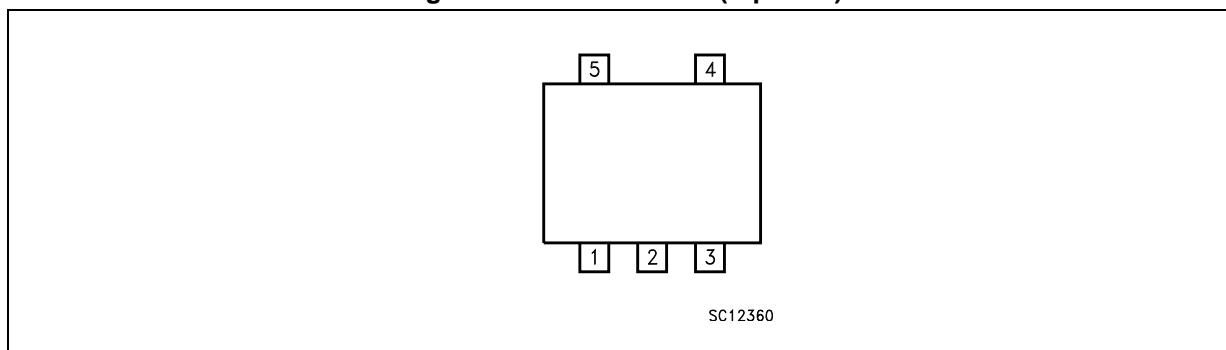


Table 2. Pin description

Pin n°	Symbol	Note
1	SHDN	Shutdown input disables the regulator when it is connected to GND or to positive voltage less than 0.6 V
2	GND	Ground pin internally connected to the die attach flag to decrease the total thermal resistance and increase the package ability to dissipate power
3	Bypass	Bypass pin with 0.1 $\mu$ F to improve the noise performance
4	OUT	Output port
5	IN	Input port

### 3 Maximum ratings

**Table 3. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_I$	DC input voltage	16	V
$V_{SHDN}$	DC input voltage	16	V
$I_O$	Output current	Internally limited	
$T_{STG}$	Storage temperature range	-55 to 150	°C
$T_{OP}$	Operating junction temperature range	-40 to 125	°C

**Table 4. Thermal data**

Symbol	Parameter	SOT23-5L	Unit
$R_{thJC}$	Thermal resistance junction-case	81	°C/W
$R_{thJA}$	Thermal resistance junction-ambient	255	°C/W

## 4 Electrical characteristics

$T_J = 25\text{ °C}$ ,  $V_{IN} = V_{OUT} + 1\text{ V}$ ,  $I_{OUT} = 0\text{ mA}$ ,  $V_{SHDN} = 1.8\text{ V}$ ,  $C_I = 1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$ ,  $C_{BYPASS} = 0.1\text{ }\mu\text{F}$  unless otherwise specified.

**Table 5. LK112 electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_q$	Quiescent current	On mode (except $I_{SHDN}$ )		175	250	$\mu\text{A}$
		Off mode, $V_I = 8\text{V}$ , $V_{SHDN} = 0\text{V}$		0	0.1	$\mu\text{A}$
$V_O$	Output voltage	$I_O = 30\text{mA}$	-2		+2	%
$\Delta V_O$	Line regulation	$V_I = V_O + 1\text{V}$ to $V_O + 6\text{V}$ , $V_O \leq 5.6\text{V}$		0.7	20	mV
		$V_I = V_O + 1\text{V}$ to $V_O + 6\text{V}$ , $V_O > 5.6\text{V}$		0.8	40	mV
$\Delta V_O$	Load regulation	$I_O = 1$ to $60\text{mA}$		15	30	mV
		$I_O = 1$ to $150\text{mA}$		25	90	mV
$V_d$	Dropout voltage	$I_O = 60\text{mA}$ <sup>(1)</sup>		0.17	0.24	V
		$I_O = 150\text{mA}$ <sup>(1)</sup>		0.29	0.35	V
$I_O$	Output current limit		150			mA
SVR	Supply voltage rejection	$V_I = V_O + 1.5\text{V}$ , $C_{BYP} = 0.1\text{ }\mu\text{F}$ $C_O = 10\text{ }\mu\text{F}$ , $f = 400\text{Hz}$ , $I_O = 30\text{mA}$		55		dB
eN	Output noise voltage	B= 10Hz to 80kHz, $C_{BYP} = 0.1\text{ }\mu\text{F}$ $C_O = 10\text{ }\mu\text{F}$ , $V_I = V_O + 1.5\text{V}$ , $I_O = 60\text{mA}$		30		$\mu\text{Vrms}$
$I_{SHDN}$	Shutdown input current	$V_{SHDN} = 1.8\text{V}$ , output on		12	35	$\mu\text{A}$
$V_{SHDN}$	Shutdown input logic	Output on	1.8			V
		Output off			0.6	
$\Delta V_O/T_J$	Output voltage temperature coefficient	$I_O = 10\text{mA}$		0.09		mV/°C

1. For versions with output voltage more than 2.1 V only.

*Note:* For version with output voltage less than 2 V,  $V_{IN} = 2.4\text{ V}$ .

## 5 Typical characteristics

Unless otherwise specified,  $T_J = 25\text{ }^\circ\text{C}$ ,  $C_I = 1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$ ,  $C_{BYP} = 100\text{ nF}$

Figure 3. Output voltage vs. temperature ( $V_O = 2.5\text{V}$ )

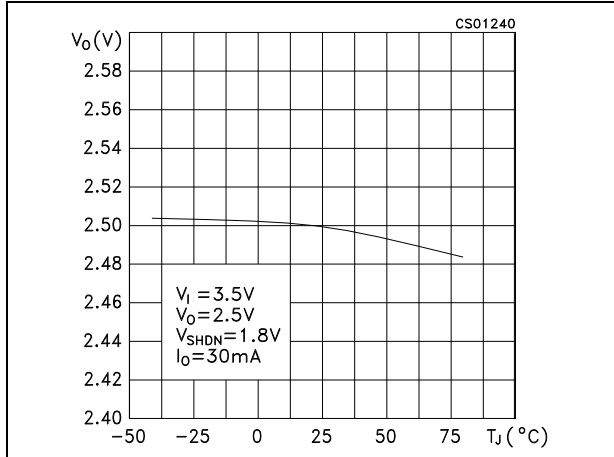


Figure 4. Output voltage vs. temperature ( $V_O = 3.8\text{V}$ )

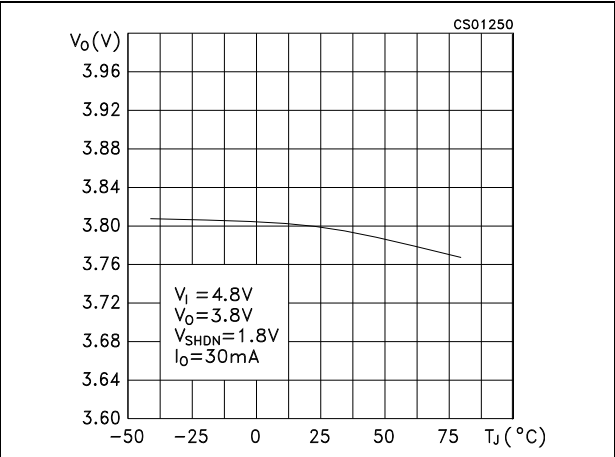


Figure 5. Line regulation vs. temperature

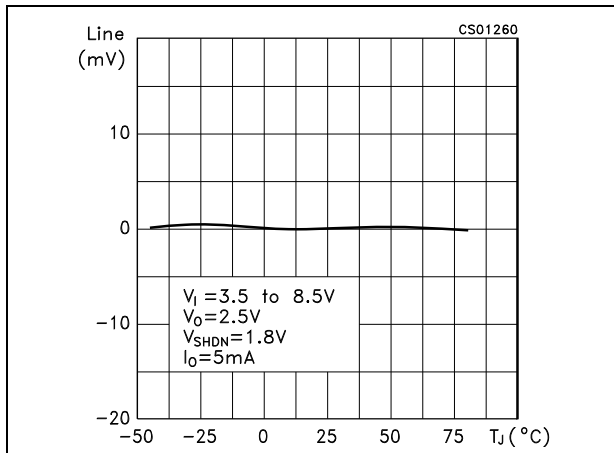


Figure 6. Load regulation vs. temperature

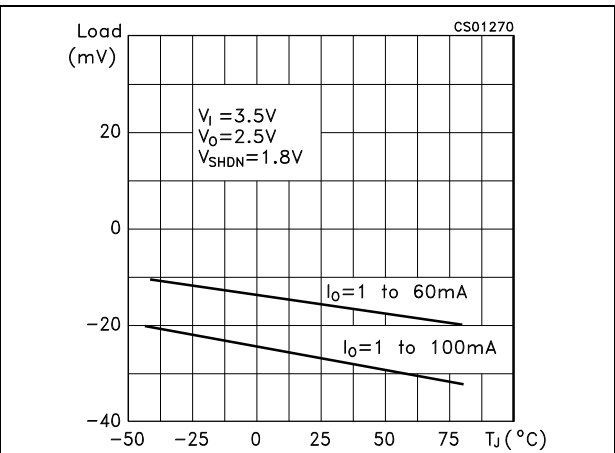


Figure 7. Dropout voltage vs. temperature

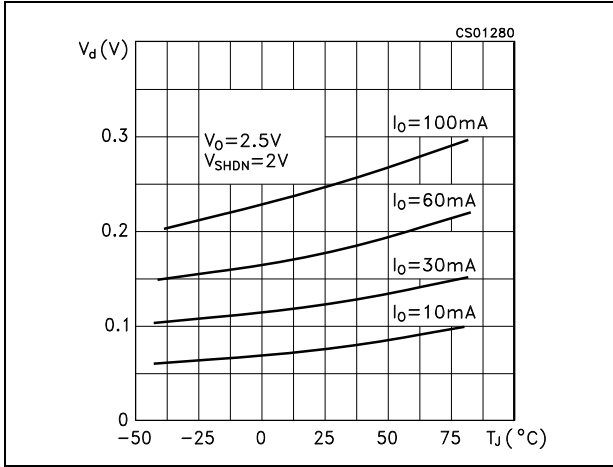


Figure 8. Short-circuit current vs. dropout voltage

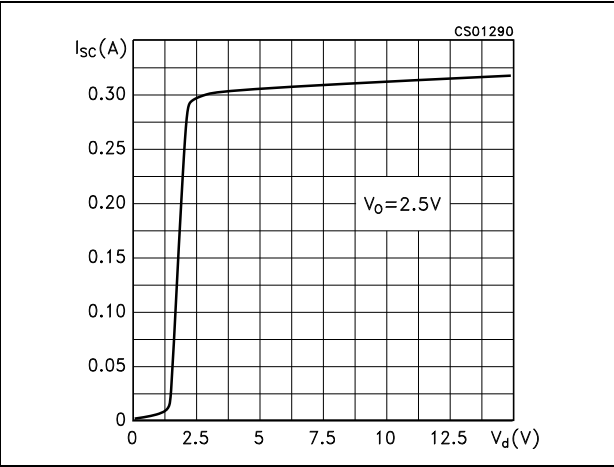


Figure 9. Output voltage vs. input voltage

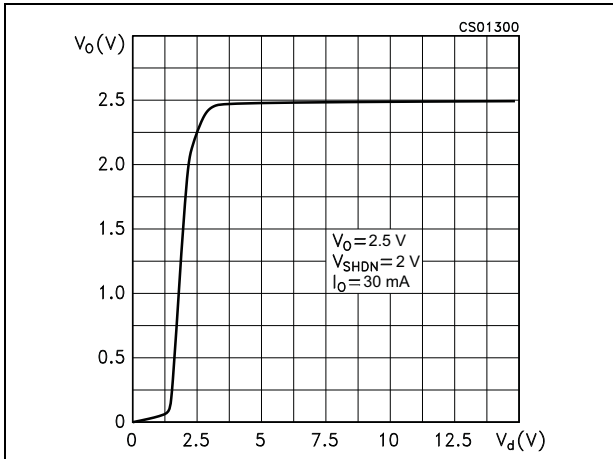


Figure 10. Shutdown voltage vs. temperature

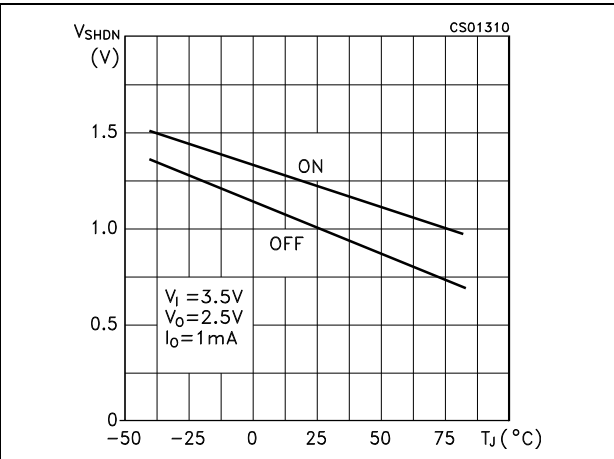


Figure 11. Shutdown current vs. shutdown voltage

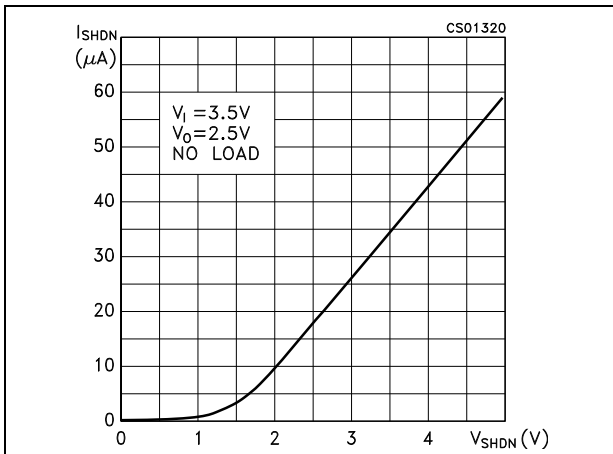


Figure 12. Supply voltage rejection vs. temperature ( $V_o = 2.5V$ )

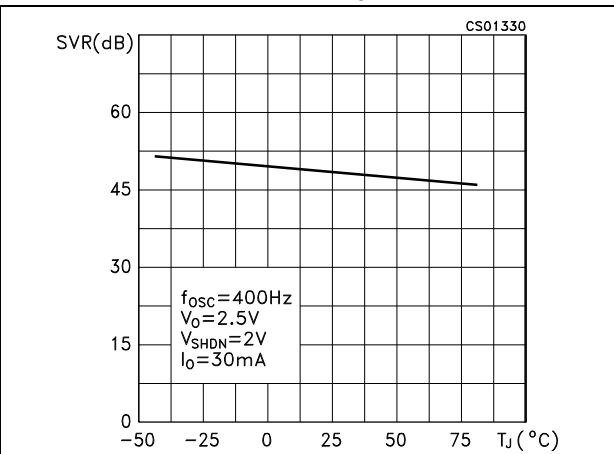




Figure 13. Supply voltage rejection vs. output current

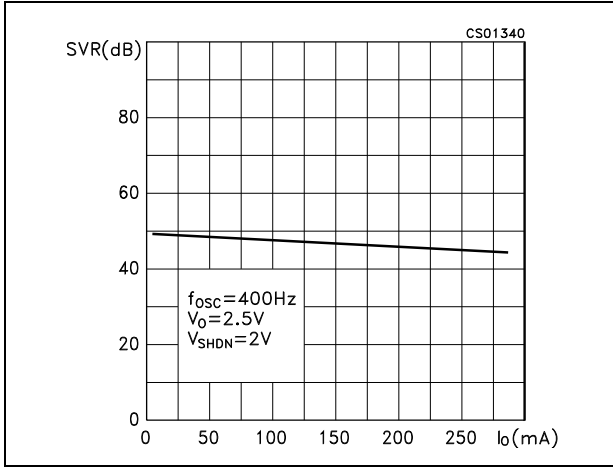


Figure 14. Supply voltage rejection vs. frequency

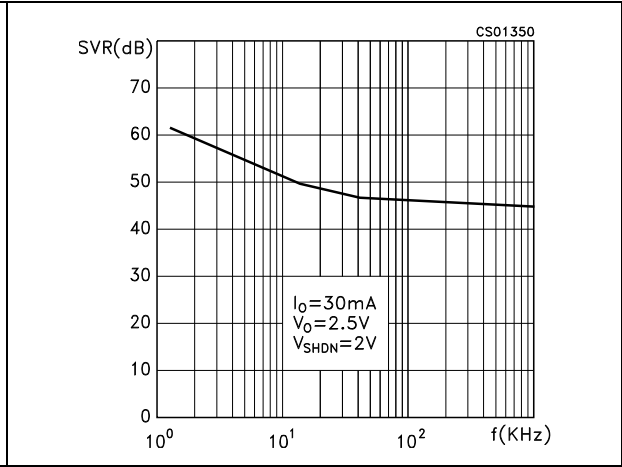


Figure 15. Supply voltage rejection vs. temperature ( $V_o=3.8V$ )

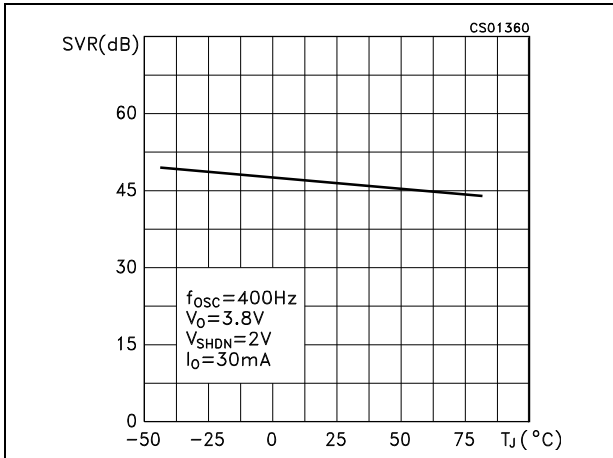


Figure 16. Quiescent current vs. temperature

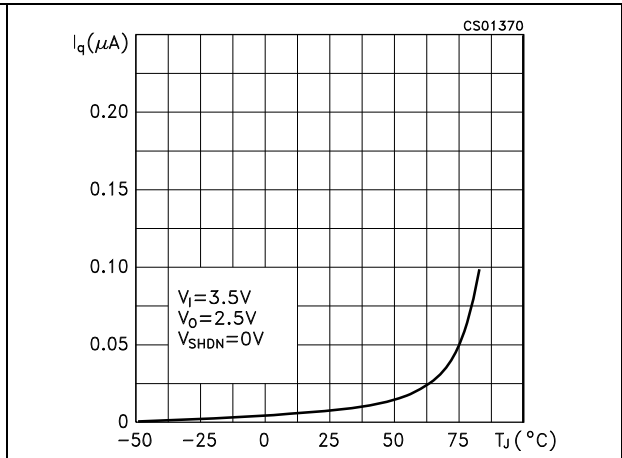


Figure 17. Quiescent current vs. input voltage

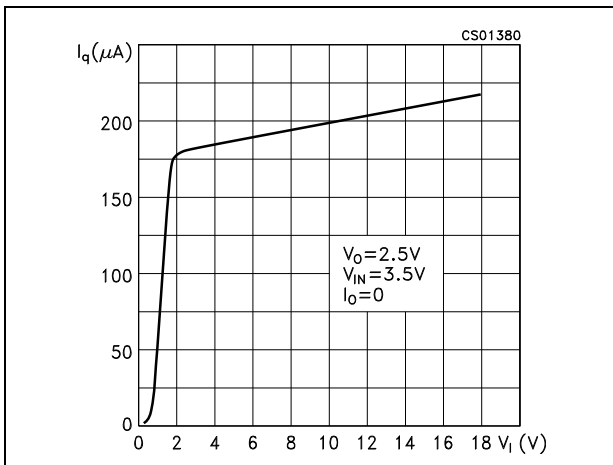


Figure 18. Quiescent current vs. shutdown voltage

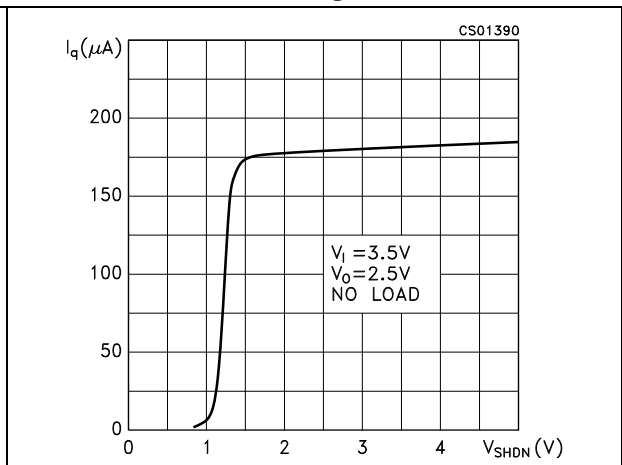


Figure 19. Quiescent current vs. output current    Figure 20. Reverse current vs. reverse voltage

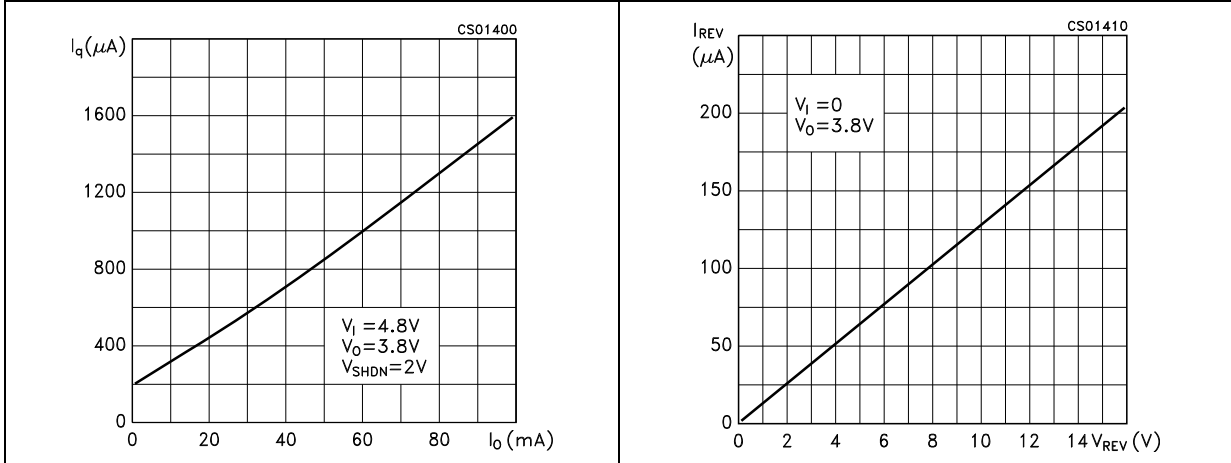


Figure 21. Stability

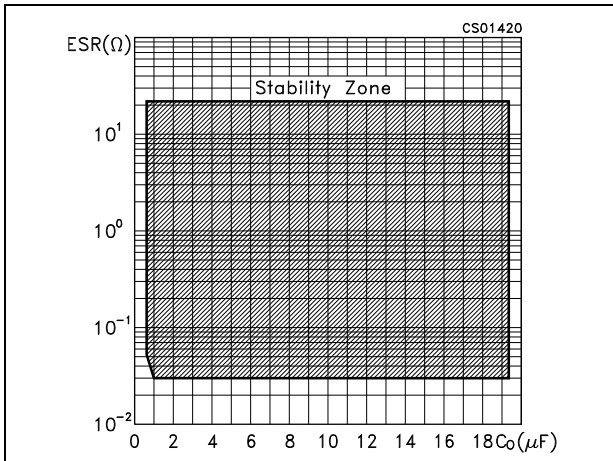


Figure 22. Noise spectrum

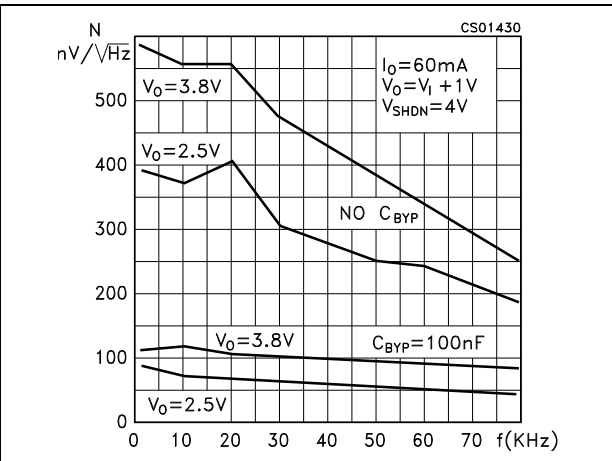


Figure 23. Start-up transient ( $C_{BYP} = 10 \text{ nF}$ )

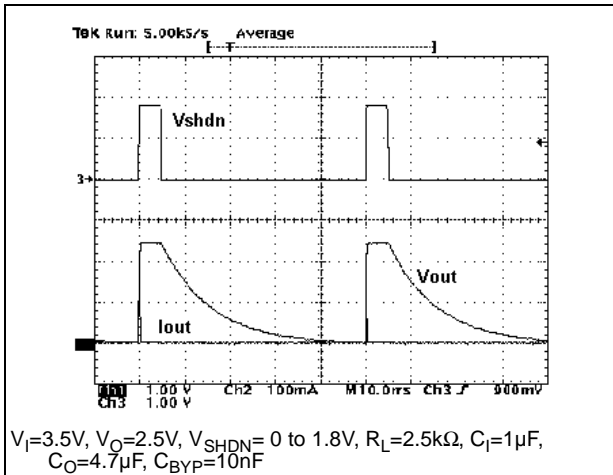


Figure 24. Start-up transient ( $C_{BYP} = 100 \text{ nF}$ )

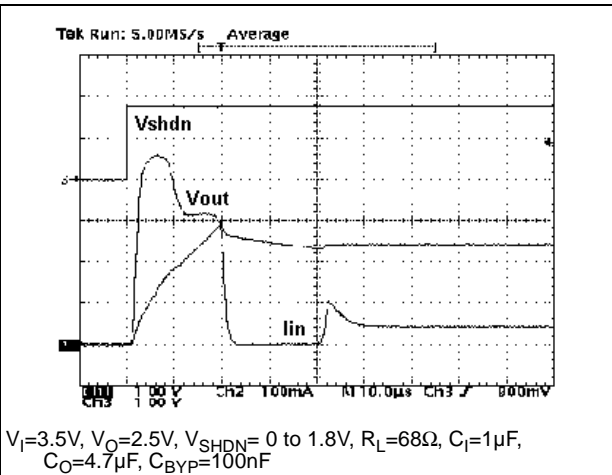


Figure 25. Line transient ( $C_o = 100 \mu\text{F}$ )

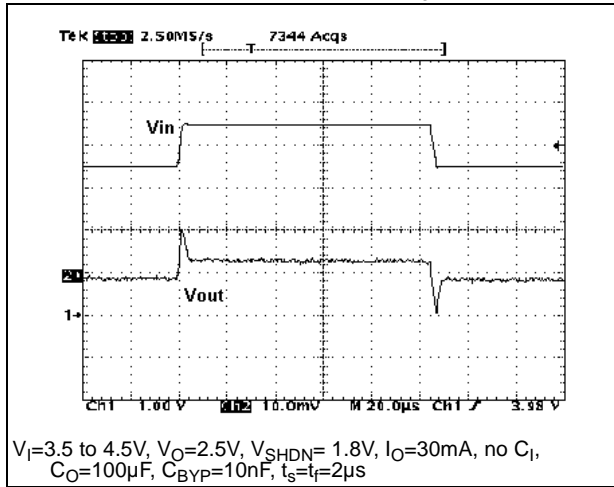


Figure 26. Line transient ( $C_o = 10 \mu\text{F}$ )

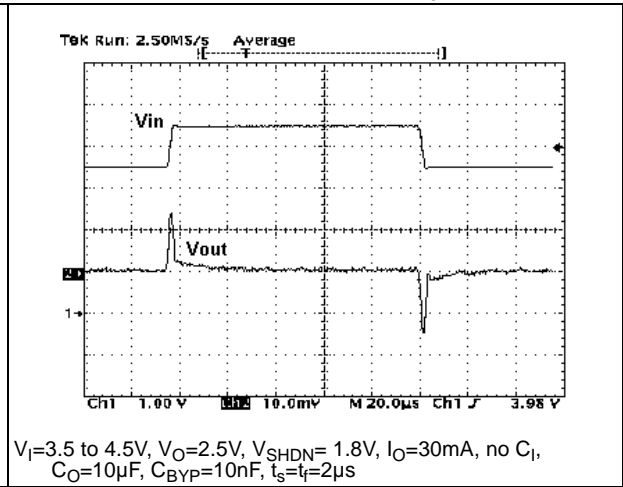


Figure 27. Line transient ( $C_o = 1 \mu\text{F}$ )

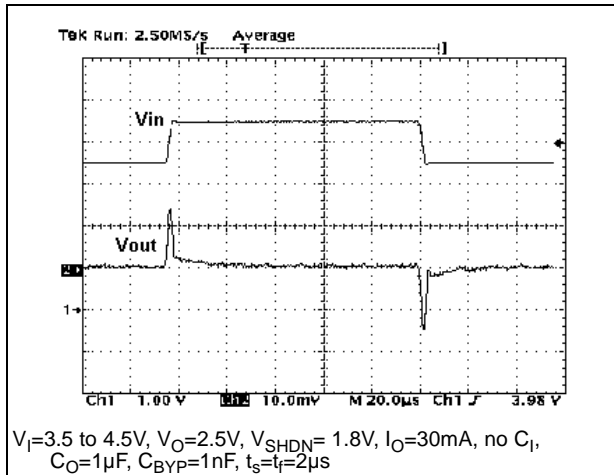


Figure 28. Load transient ( $C_o = 2.2 \mu\text{F}$ ,  $C_{\text{BYP}} = 10 \text{ nF}$ )

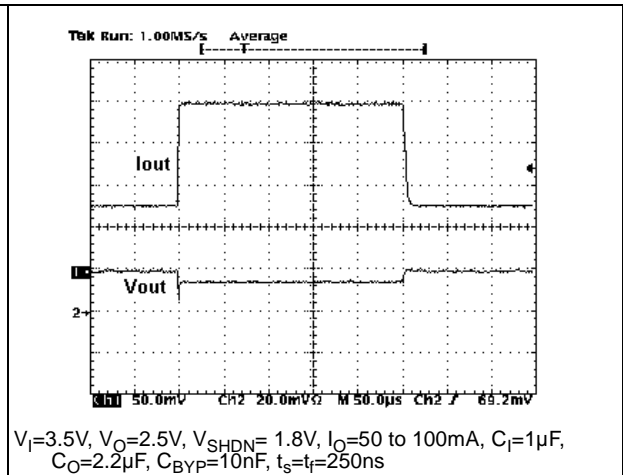


Figure 29. Load transient ( $C_O = 10 \mu\text{F}$ ,  $C_{BYP} = 100 \text{ nF}$ )

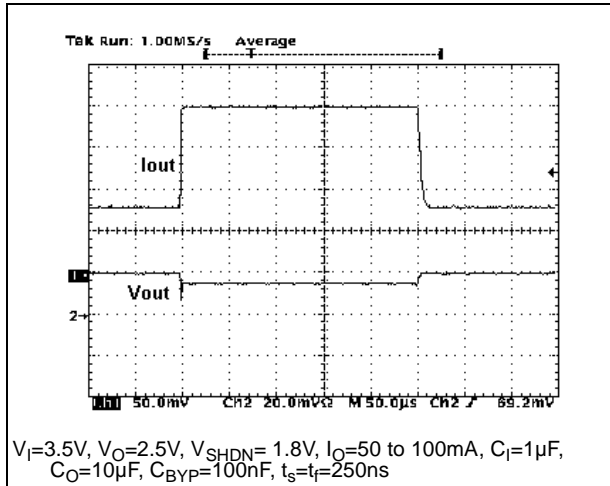
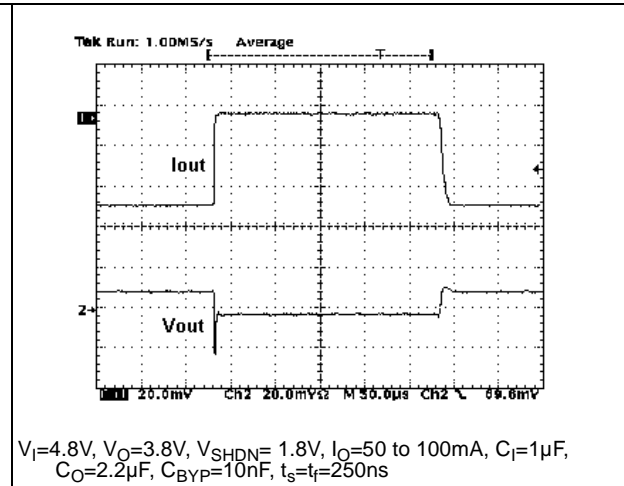


Figure 30. Load transient ( $V_O = 3.8 \text{ V}$ )



## 6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

Figure 31.SOT23-5L mechanical drawings

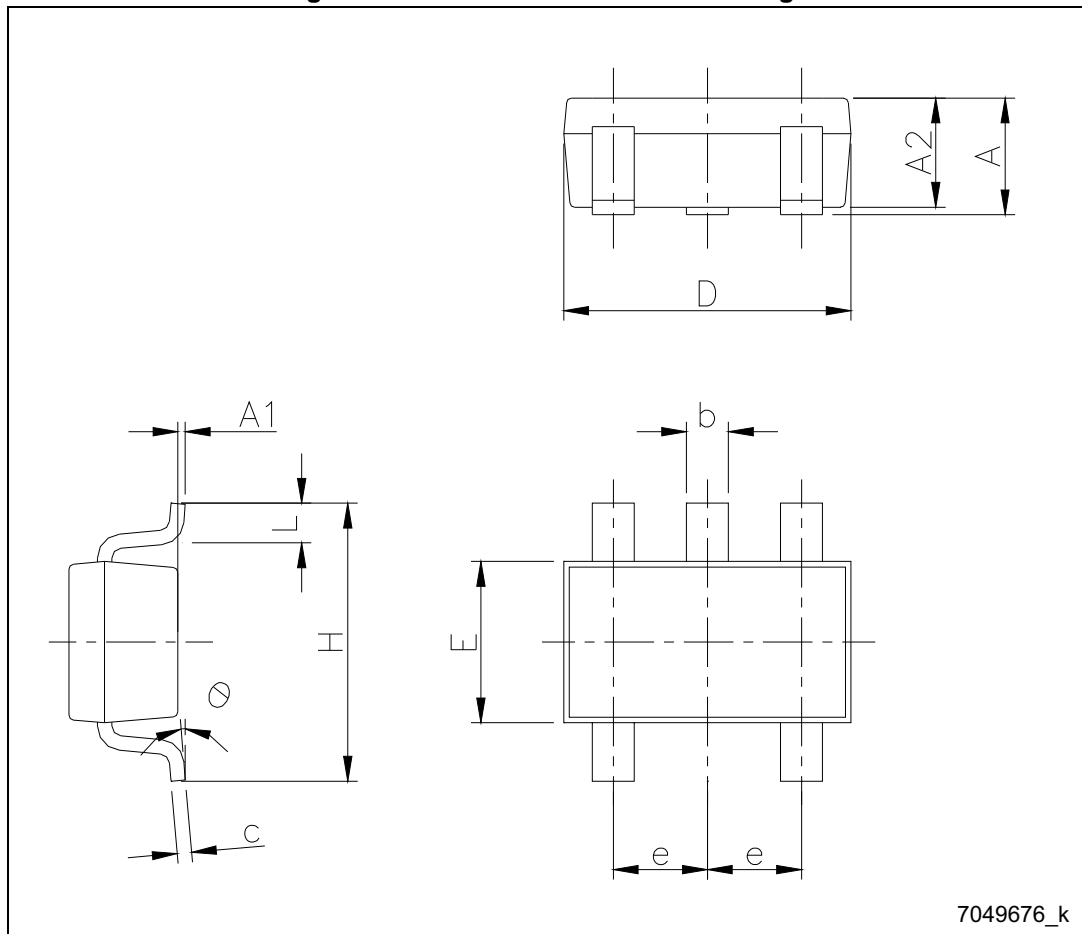
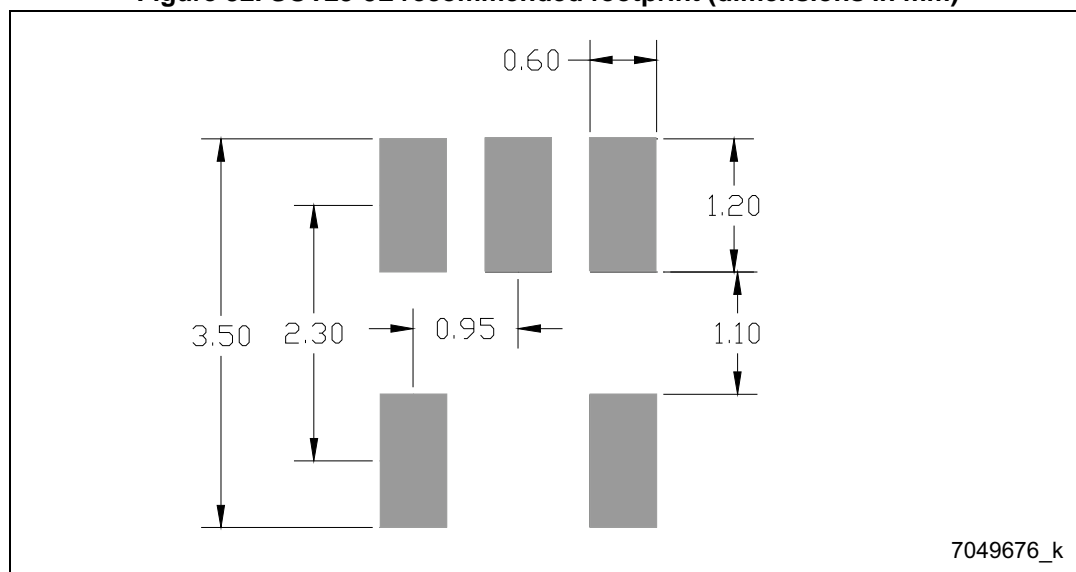


Table 6. SOT23-5L mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.90		1.45
A1	0		0.15
A2	0.90		1.30
b	0.30		0.50
c	2.09		0.20
D		2.95	
E		1.60	
e		0.95	
H		2.80	
L	0.30		0.60
$\theta$	0		8

Figure 32. SOT23-5L recommended footprint (dimensions in mm)



## 7 Packaging mechanical data

Figure 33. Tape and reel SOT23-5L mechanical drawings

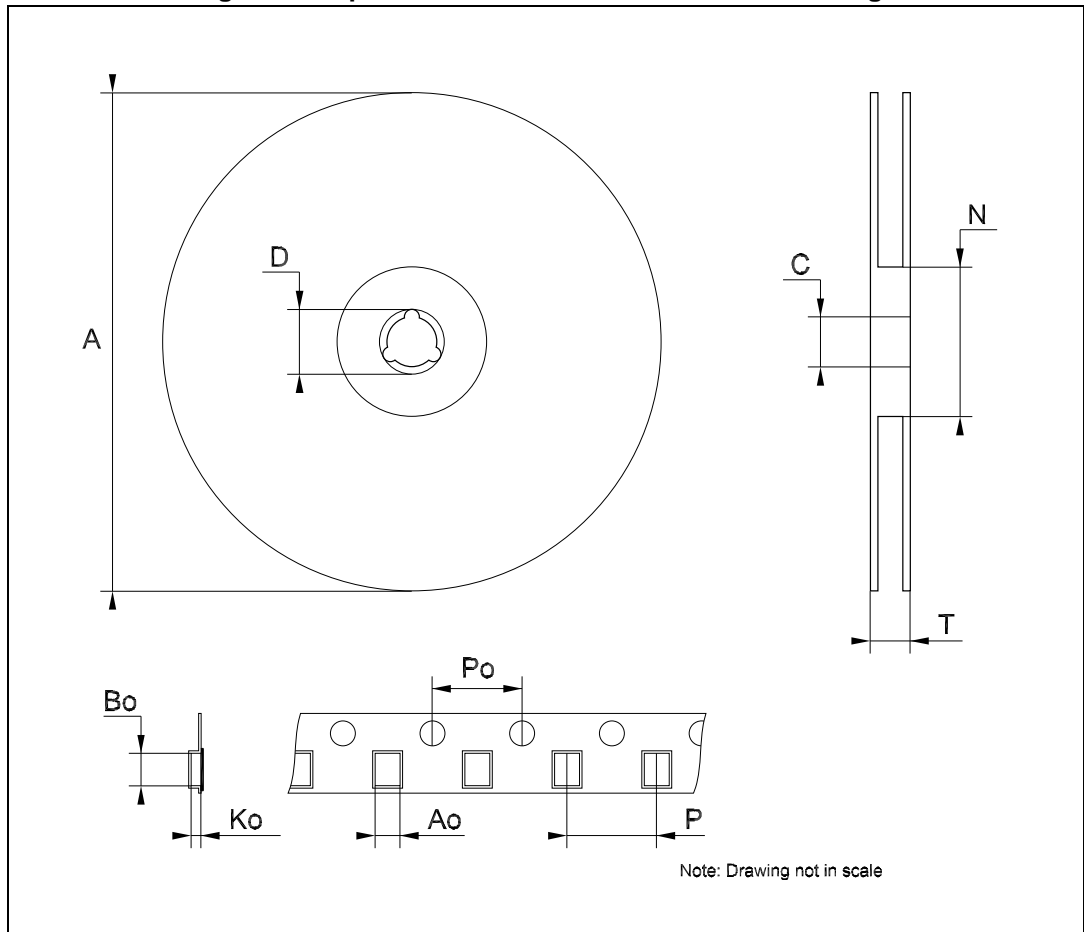


Figure 34. Tape and reel SOT23-5L mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			180
C	12.8	13.0	13.2
D	20.2		
N	60		
T			14.4
Ao	3.13	3.23	3.33
Bo	3.07	3.17	3.27
Ko	1.27	1.37	1.47
Po	3.9	4.0	4.1
P	3.9	4.0	4.1



## 8 Revision history

**Table 7. Document revision history**

Date	Revision	Changes
31-Jan-2005	8	Change maturity code.
13-Jun-2006	9	Order codes updated and new template.
17-Oct-2006	10	The T <sub>OP</sub> value on table 2 has been updated.
18-Jul-2007	11	Add <a href="#">Table 1</a> in cover page.
21-Sep-2007	12	Features updated.
11-Dec-2007	13	Modified: <a href="#">Table 1</a> .
12-Feb-2008	14	Modified: <a href="#">Table 1</a> .
10-Jul-2008	15	Modified: <a href="#">Table 1</a> and <a href="#">Table 1 on page 1</a> .
28-Feb-2011	16	Modified: <a href="#">Table 1</a> .
24-Apr-2014	17	<p>Changed the part number LK112xx to LK112.</p> <p>Updated the Title in cover page and <a href="#">Table 1: Device summary</a>.</p> <p>Updated the features and description in cover page, <a href="#">Table 2: Pin description</a>, <a href="#">Figure 3: Output voltage vs. temperature (VO= 2.5V)</a>, <a href="#">Figure 4: Output voltage vs. temperature (VO= 3.8V)</a>, <a href="#">Section 5: Typical characteristics</a>, <a href="#">Section 6: Package mechanical data</a>.</p> <p>Added <a href="#">Section 7: Packaging mechanical data</a>.</p> <p>Minor text changes.</p>

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