

Low noise and low drop voltage regulator with shutdown function

Datasheet - production data



Description

The LK112S is a low-dropout linear regulator with shutdown function. The internal switch can be controlled by TTL or CMOS logic levels. The device is ON when the control pin is pulled to a high logic level. An external capacitor can be connected to the noise bypass pin to reduce the output noise level to 30 μVrms . An internal PNP pass transistor is used to achieve a low-dropout voltage.

The LK112S has a very low quiescent current in ON mode while in OFF mode the I_q is reduced to 100 nA max. The internal thermal shutdown circuitry limits the junction temperature below 150 °C. The load current is internally monitored and in the presence of a short-circuit or overcurrent conditions at the output, the device shuts down.

Features

- Output current up to 200 mA
- Low-dropout voltage (500 mV max. at $I_{OUT} = 200$ mA)
- Very low quiescent current: 0.1 μA in OFF mode and max. 250 μA in ON mode at $I_{OUT} = 0$ mA
- Low output noise: typ. 30 μV at $I_{OUT} = 60$ mA and 10 Hz < f < 80 kHz
- Wide range of output voltages
- Internal current and thermal limit
- V_{OUT} tolerance $\pm 2\%$ (at 25 °C)
- 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)

Table 1. Device summary

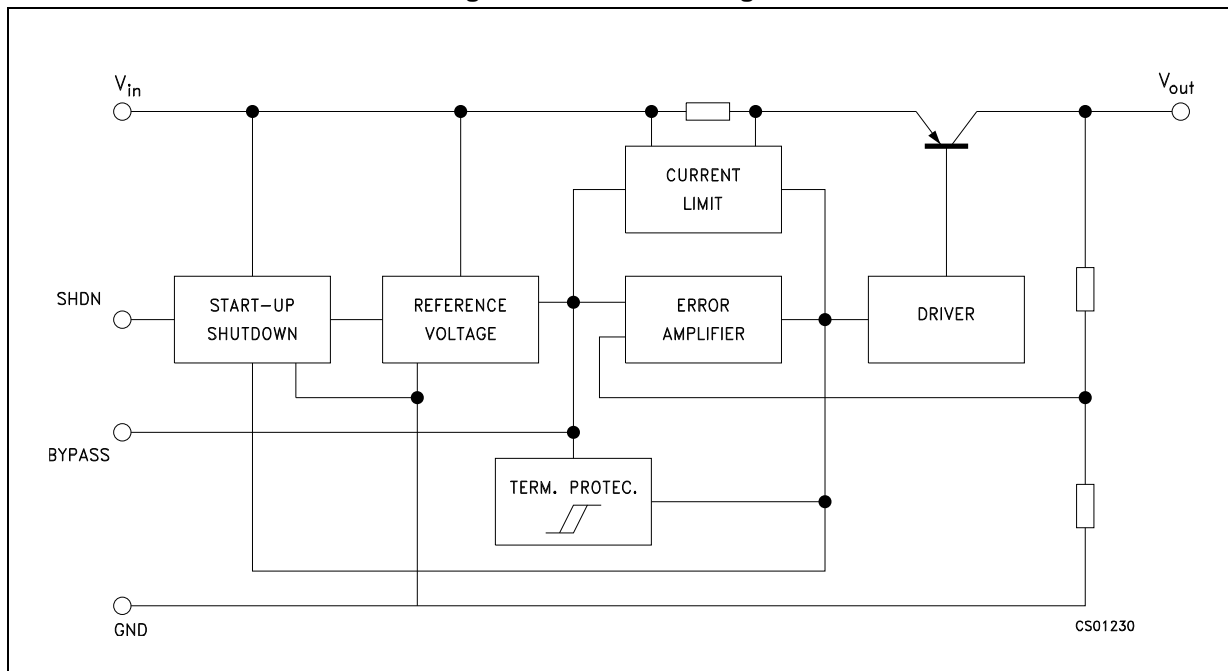
Part number	Output voltage
LK112SM18TR	1.8 V
LK112SM33TR	3.3 V
LK112SM50TR	5.0 V

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1 Diagram

Figure 1. Schematic diagram



2 Pin configuration

Figure 2. Pin connection (top view)

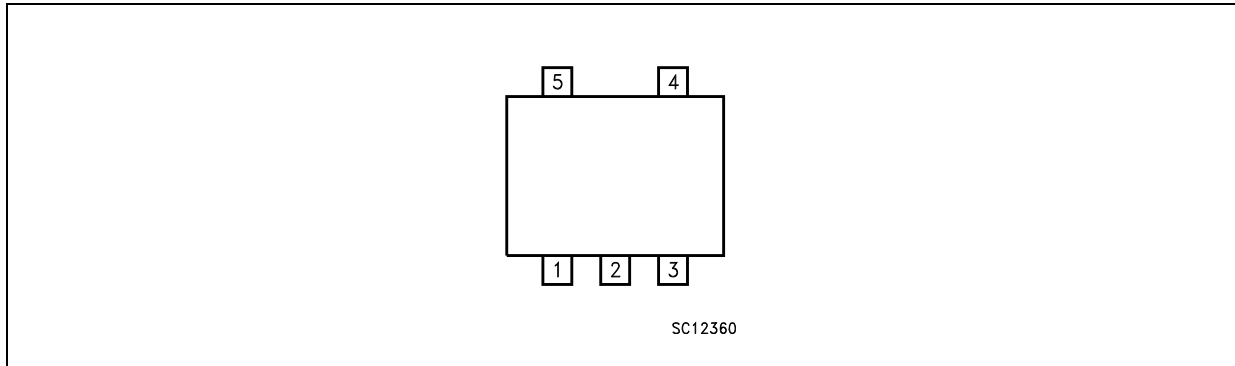


Table 2. Pin description

Pin n°	Symbol	Note
1	SHDN	Shutdown input disables the regulator when it is connected to GND or to a positive voltage lower 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: 0.1 μ F bypass to improve the thermal 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

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

Table 5. LK112S electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_d	Quiescent current	ON mode (except I_{SHDN})		175	250	μA
		OFF mode, $V_I = 8\text{ V}$, $V_{SHDN} = 0\text{ V}$		0	0.1	μA
V_O	Output voltage	$I_O = 30\text{ mA}$	-2		+2	%
ΔV_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
ΔV_O	Load regulation	$I_O = 1$ to 60 mA		15	30	mV
		$I_O = 1$ to 200 mA		30	90	mV
V_d	Dropout voltage	$I_O = 60\text{ mA}$		0.17	0.24	V
		$I_O = 200\text{ mA}^{(1)}$		0.35	0.5	V
I_{SC}	Short-circuit current		200			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	$B = 10\text{ Hz}$ to 80 kHz , $C_{BYP} = 0.1\text{ }\mu\text{F}$ $C_O = 10\text{ }\mu\text{F}$, $V_I = V_O + 1.5\text{ V}$, $I_O = 60\text{ mA}$		30		μVrms
I_{SHDN}	Shutdown input current	$V_{SHDN} = 1.8\text{ V}$, output ON		12	35	μA
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/ $^\circ\text{C}$

1. For versions with an output voltage higher than 2.1 V only.

Note: For versions with an output voltage lower 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
 $V_{out}=2.5\text{ V}$

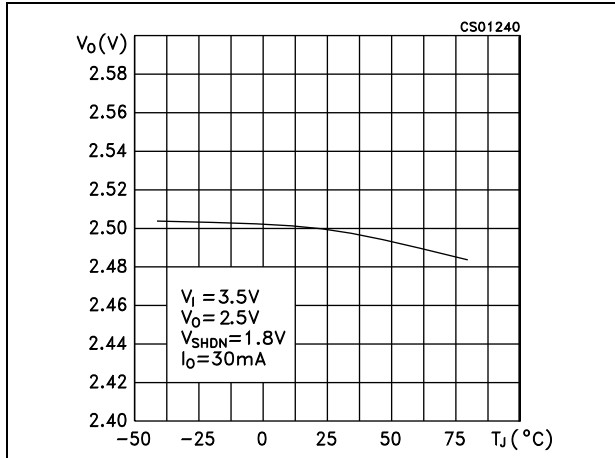


Figure 4. Output voltage vs temperature
 $V_{out}=3.8\text{ V}$

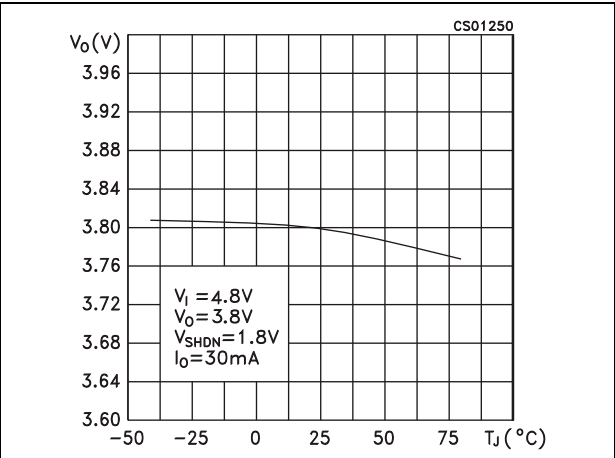


Figure 5. Line regulation vs temperature

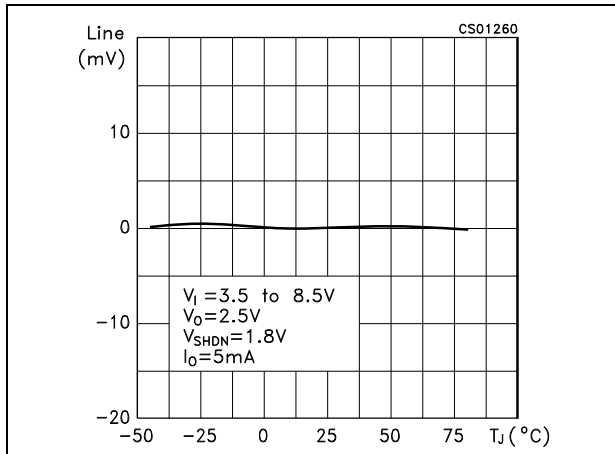


Figure 6. Load regulation vs temperature

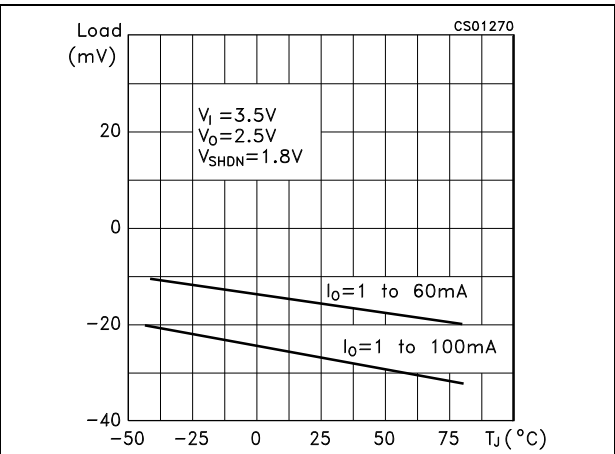


Figure 7. Dropout voltage vs temperature

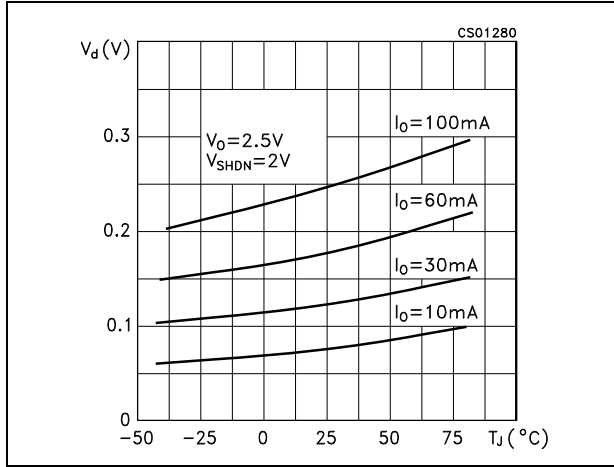


Figure 8. Short-circuit current vs dropout voltage

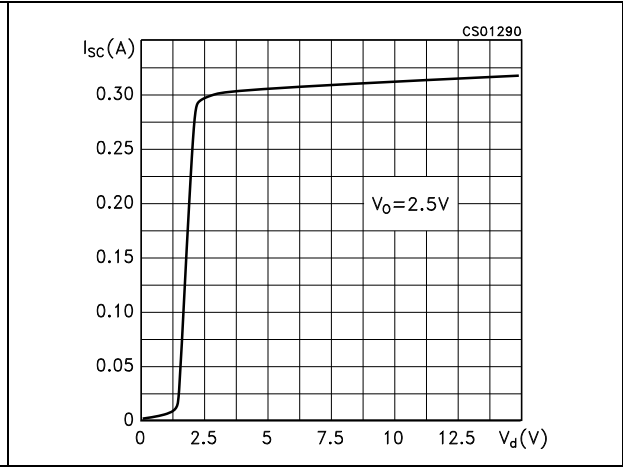


Figure 9. Output voltage vs input voltage

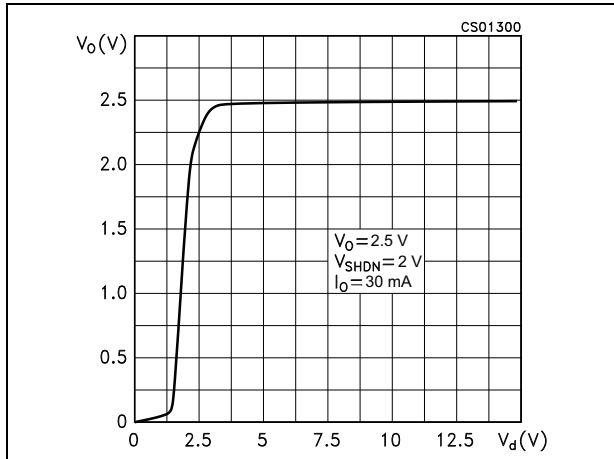


Figure 10. Shutdown voltage vs temperature

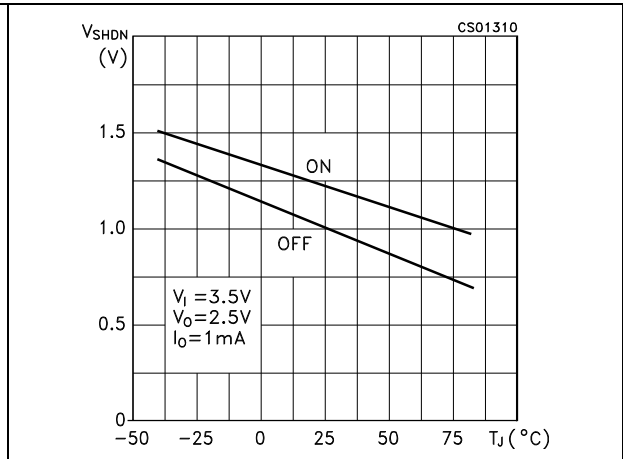


Figure 11. Shutdown current vs shutdown voltage

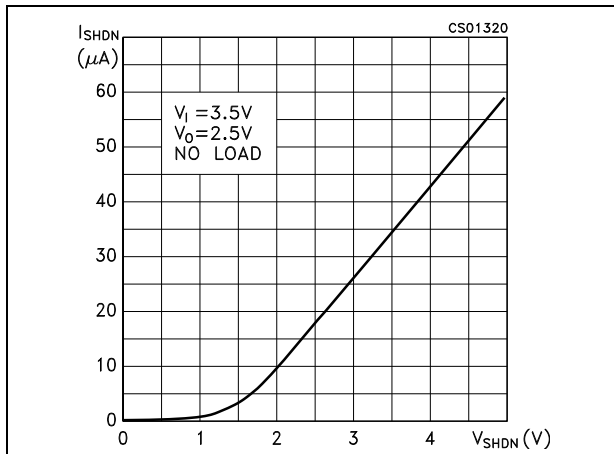


Figure 12. Supply voltage rejection vs temperature

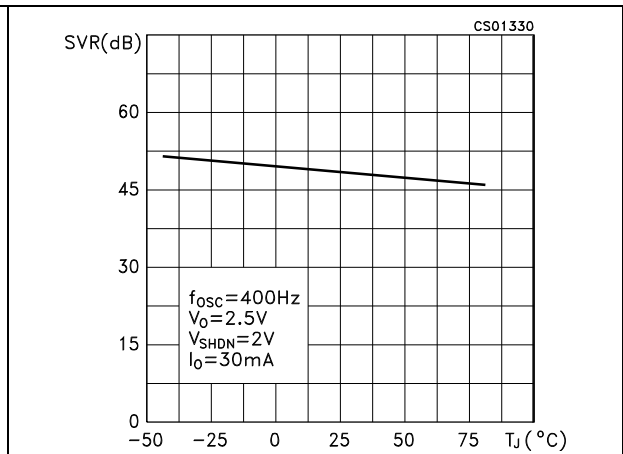


Figure 13. Supply voltage rejection vs output current

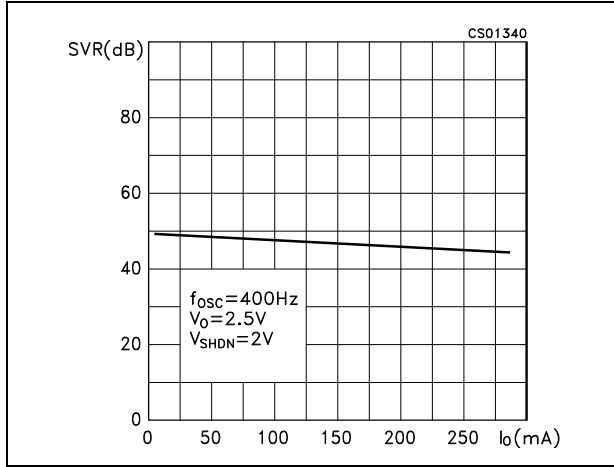


Figure 14. Supply voltage rejection vs frequency

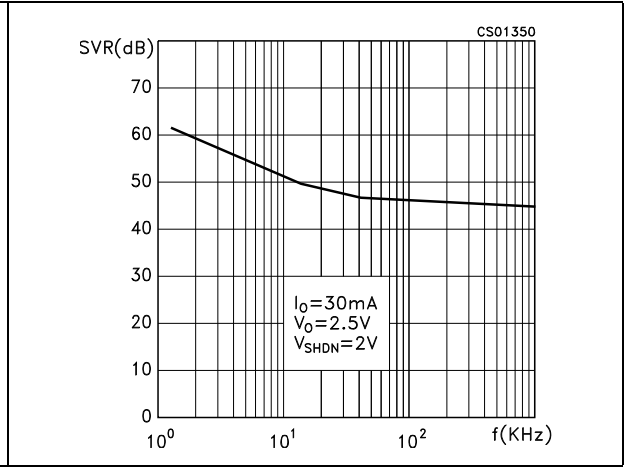


Figure 15. Supply voltage rejection vs temperature

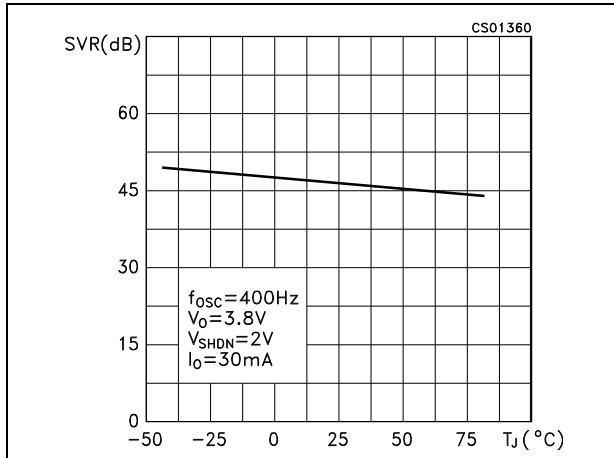


Figure 16. Shutdown current vs temperature

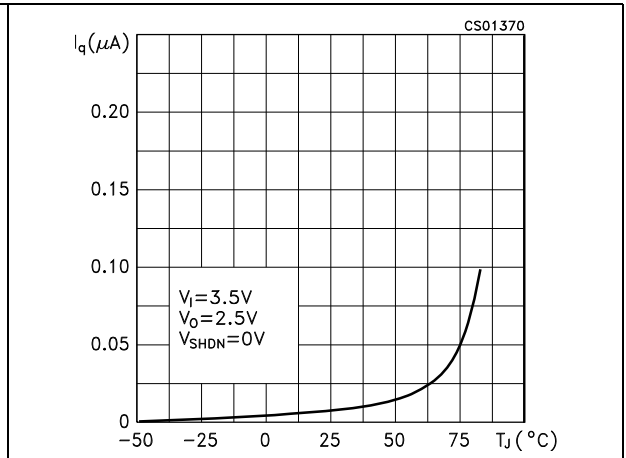


Figure 17. Quiescent current vs input voltage

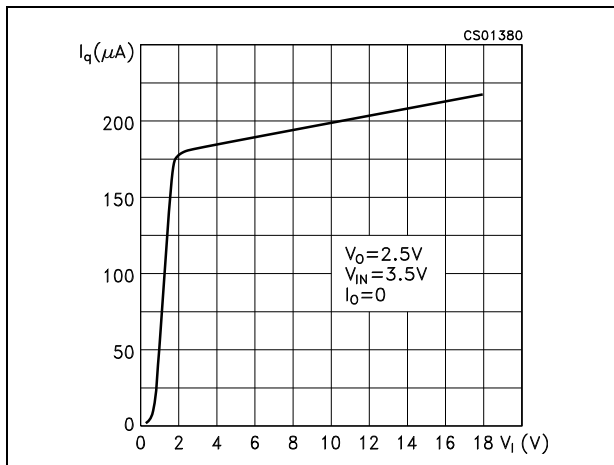


Figure 18. Quiescent current vs shutdown voltage

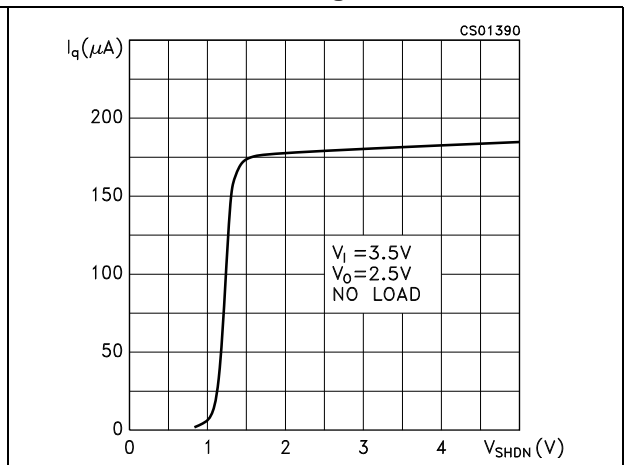


Figure 19. Quiescent current vs temperature

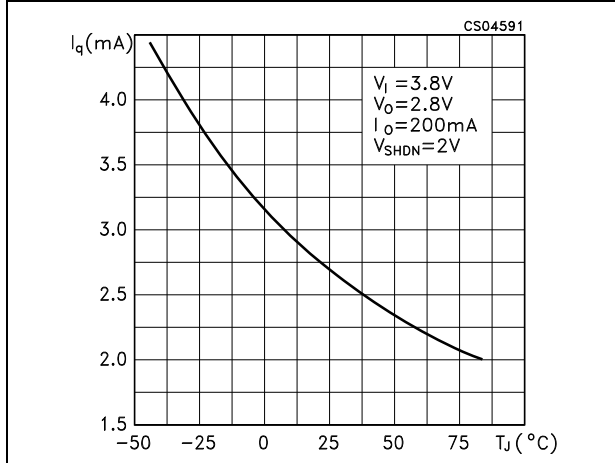


Figure 20. Reverse current vs reverse voltage

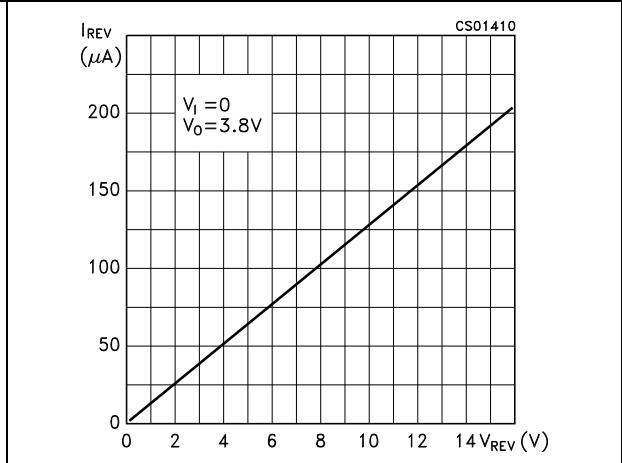


Figure 21. Stability

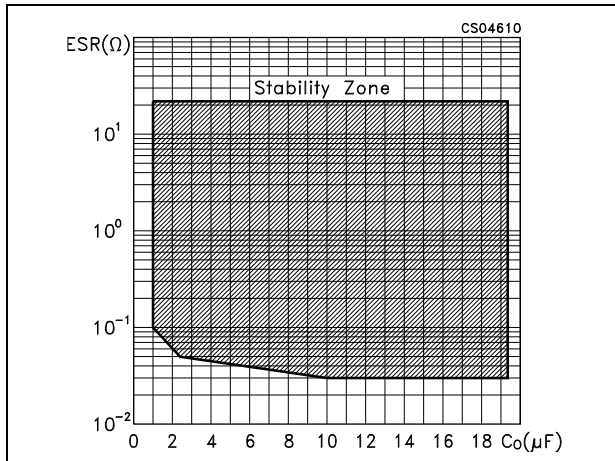


Figure 22. Noise spectrum

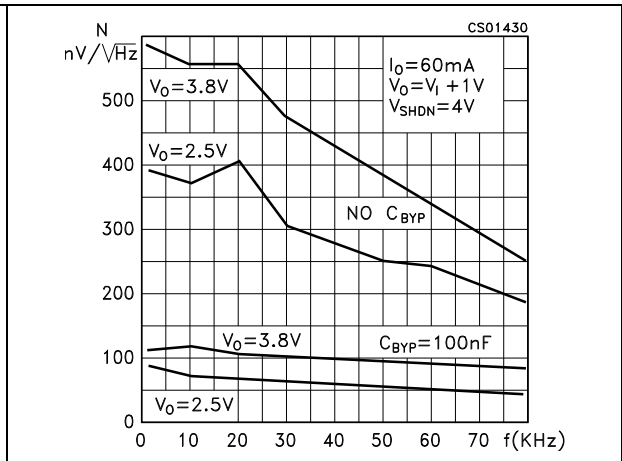


Figure 23. Start-up transient $C_{BYP}=10\ nF$

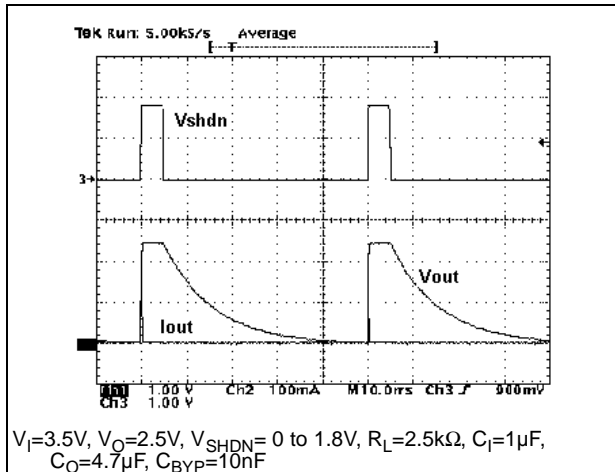


Figure 24. Start-up transient $C_{BYP}=100\ nF$

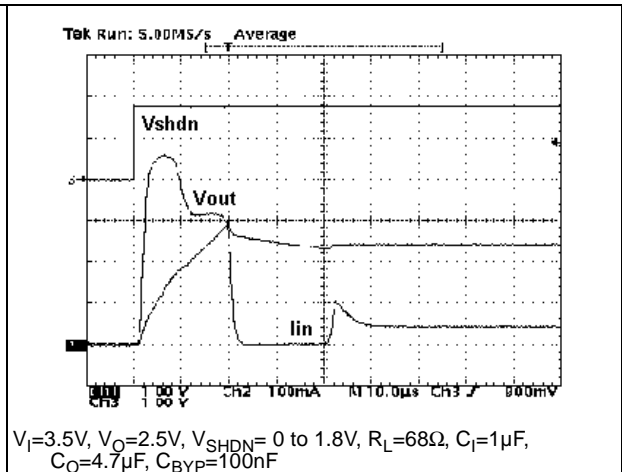


Figure 25. Line transient $C_o=100\ \mu\text{F}$

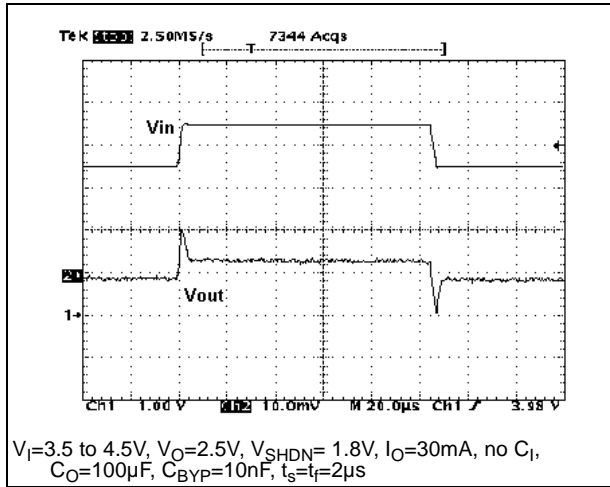


Figure 26. Line transient $C_o=10\ \mu\text{F}$

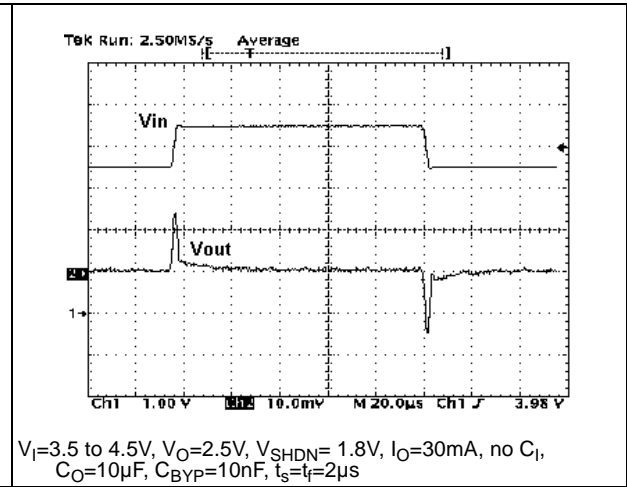


Figure 27. Line transient $C_o=1\ \mu\text{F}$

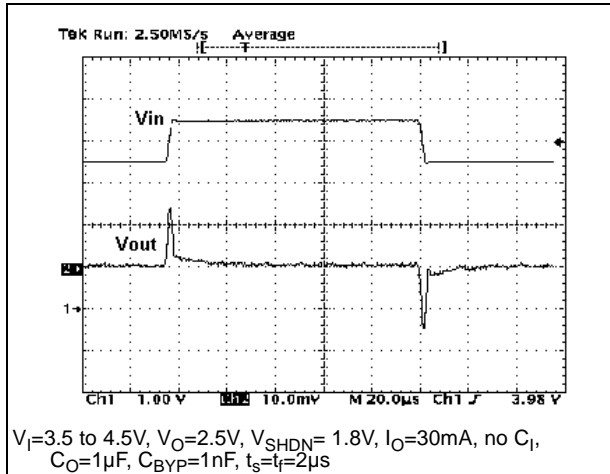


Figure 28. Load transient $V_o=2.5\ \text{V}$, $C_o=2.2\ \mu\text{F}$

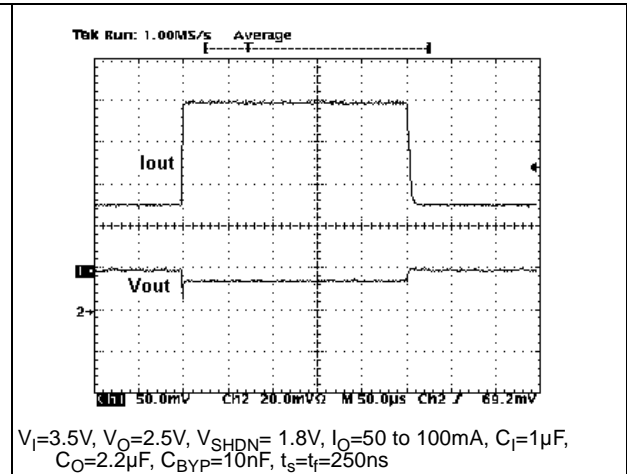


Figure 29. Load transient $V_o=2.5\ \text{V}$, $C_o=10\ \mu\text{F}$

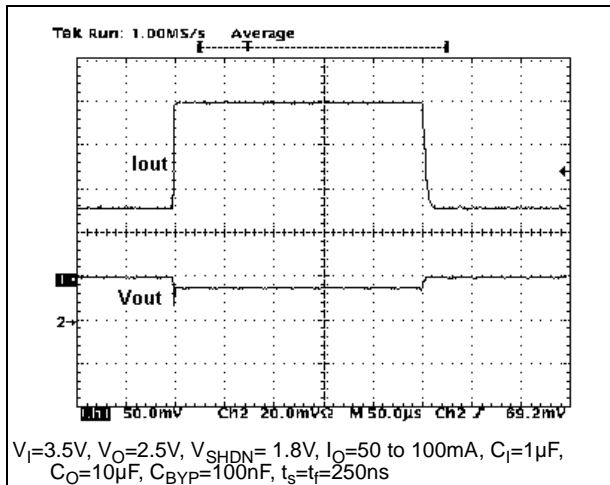
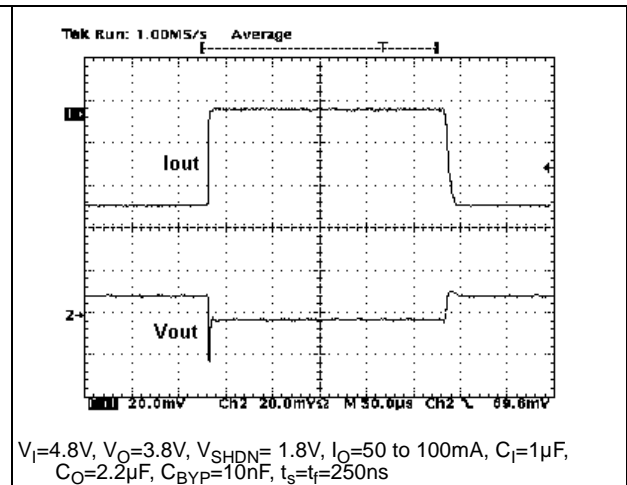


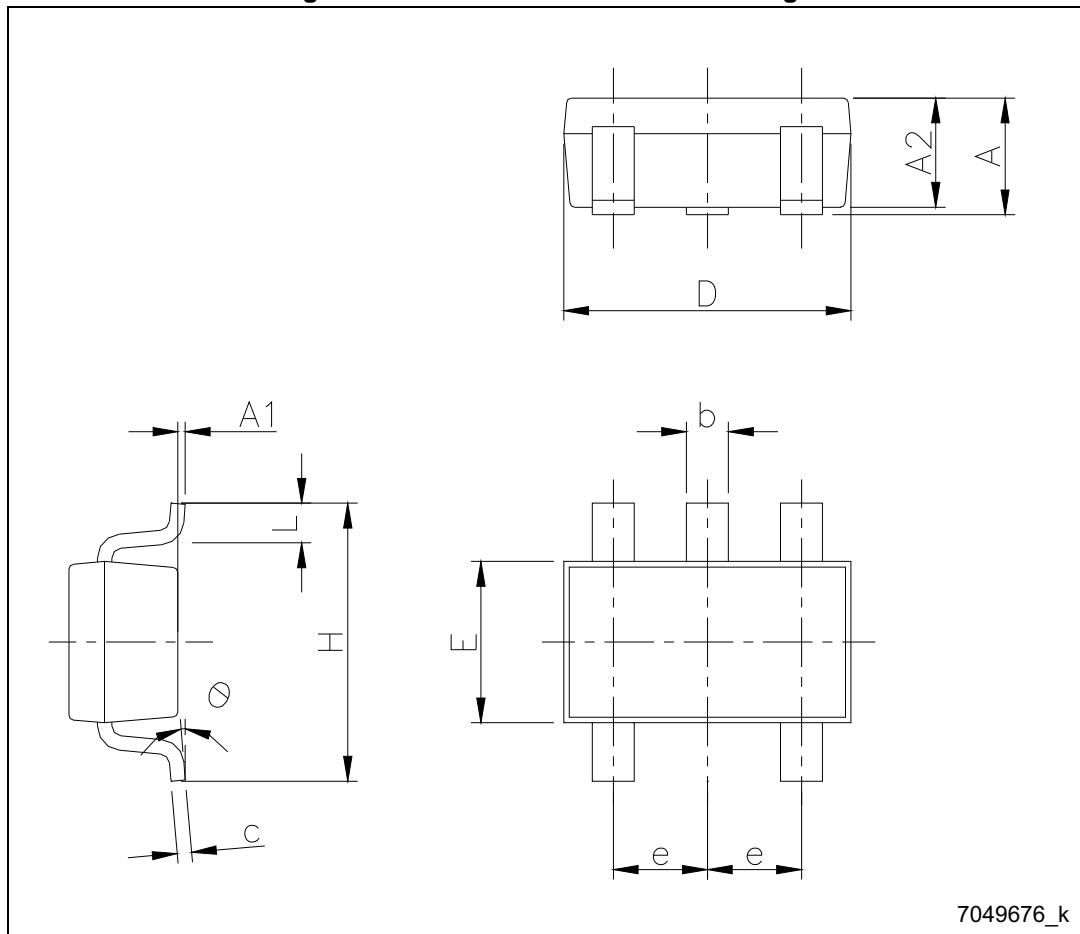
Figure 30. Load transient $V_o=3.8\ \text{V}$, $C_o=2.2\ \mu\text{F}$



6 Package mechanical data

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Figure 31. SOT23-5L mechanical drawings

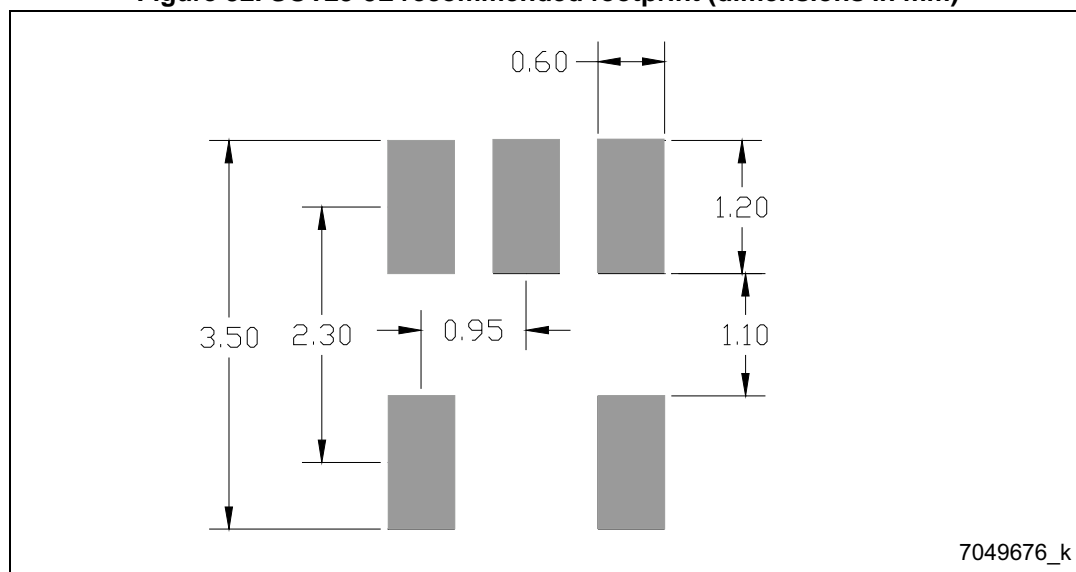


7049676_k

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
θ	0		8

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



7 Packaging mechanical data

Figure 33.SOT23-5L tape and reel drawings

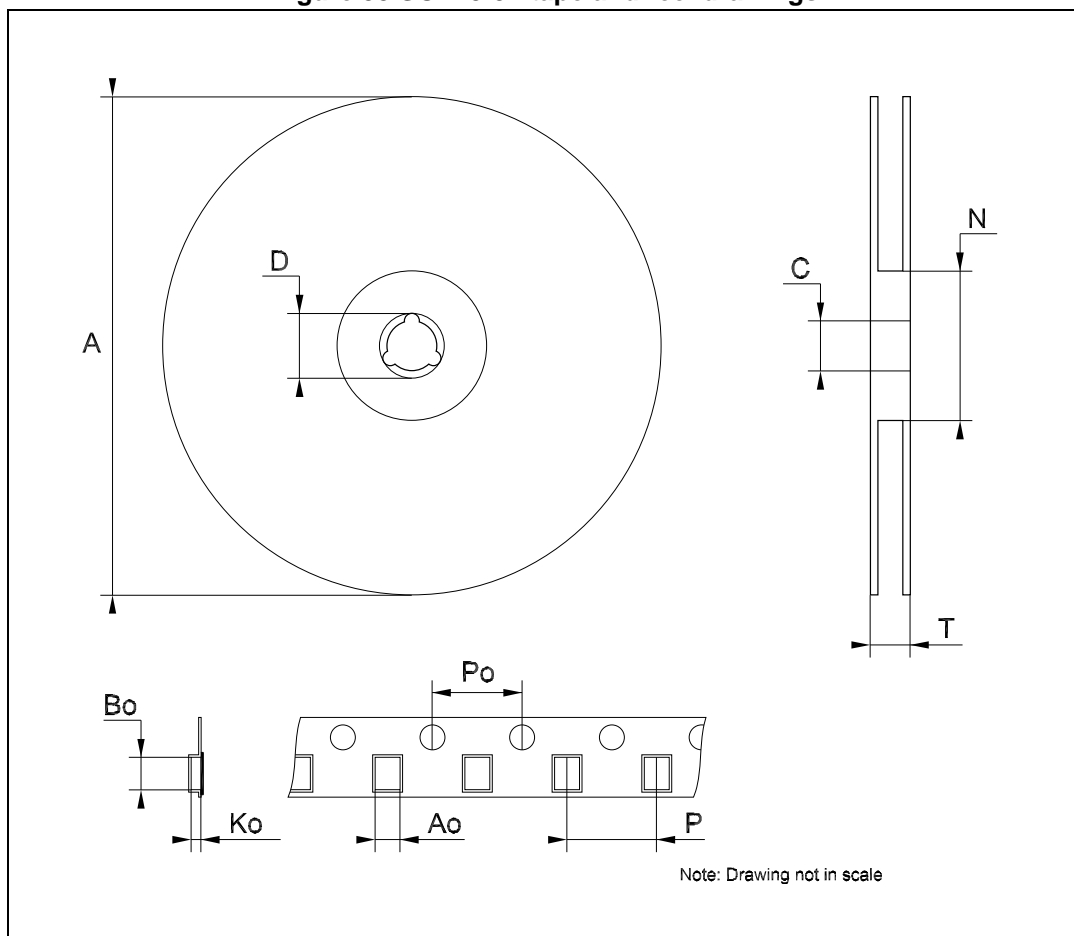


Figure 34.SOT23-5L tape and reel mechanical data

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-Aug-2004	3	Mistake on fig. 19.
31-Jan-2005	4	Change maturity code.
12-Jun-2006	5	Order codes updated.
17-Oct-2006	6	The T _{OP} value on table 2 updated.
20-Jul-2007	7	Add Table 1 in cover page.
21-Sep-2007	8	Features updated.
11-Dec-2007	9	Modified: Table 6 .
12-Feb-2008	10	Modified: Table 6 .
10-Jul-2008	11	Modified: Table 1 and Table 6 .
11-Feb-2014	12	Part number LK112Sxx changed to LK112S. Updated the title and the Description in cover page, Table 2: Pin description , Section 5: Typical characteristics and Section 6: Package mechanical data . Added Section 7: Packaging mechanical data . Minor text changes.

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