

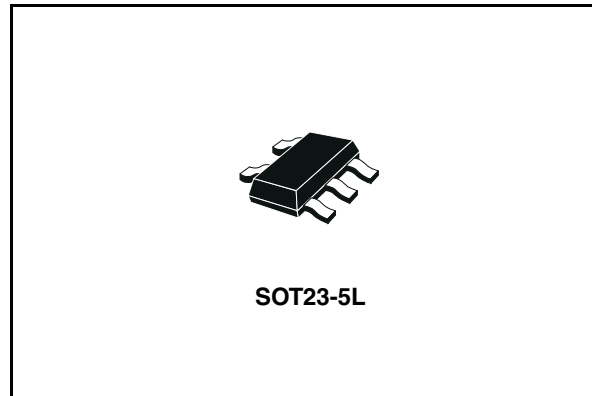
## Low noise low drop voltage regulator with shutdown function

### Features

- Output current up to 200 mA
- Low dropout voltage (500 mV max at  $I_{OUT} = 200$  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  $10$  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)

### Description

The LK112Sxx 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 used connected to the noise bypass pin to lower the output noise level to 30



$\mu$ Vrms. An internal PNP pass transistor is used to achieve a low dropout voltage.

The LK112Sxx has a very low quiescent current in ON MODE while in OFF MODE the  $I_q$  is reduced down to 100 nA max. The internal thermal shutdown circuitry limits the junction temperature to below 150 °C. The load current is internally monitored and the device will shutdown in the presence of a short circuit or overcurrent condition at the output.

**Table 1. Device summary**

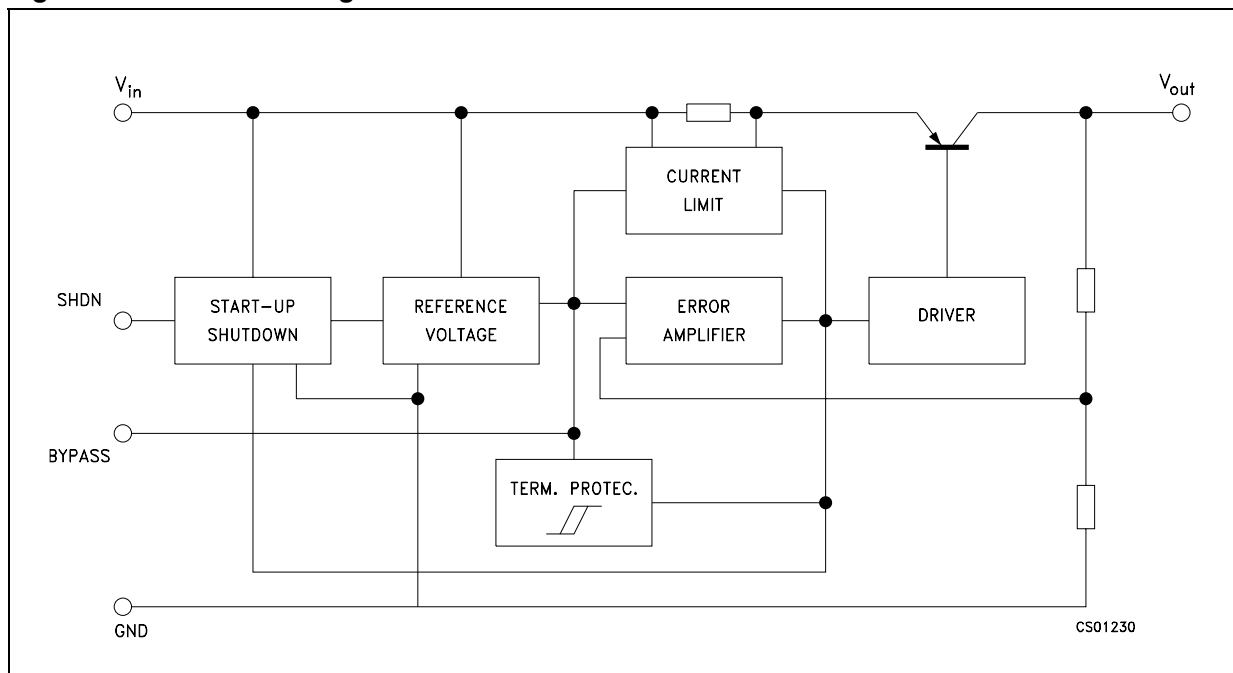
Part numbers			
LK112SXX13	LK112SXX24	LK112SXX36	LK112SXX45
LK112SXX14	LK112SXX26	LK112SXX37	LK112SXX46
LK112SXX18	LK112SXX28	LK112SXX38	LK112SXX47
LK112SXX19	LK112SXX29	LK112SXX39	LK112SXX48
LK112SXX20	LK112SXX31	LK112SXX41	LK112SXX49
LK112SXX21	LK112SXX33	LK112SXX42	LK112SXX50
LK112SXX22	LK112SXX34	LK112SXX43	
LK112SXX23	LK112SXX35	LK112SXX44	

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# 1 Diagram

Figure 1. Schematic diagram



## 2 Pin configuration

Figure 2. Pin connection (top view)

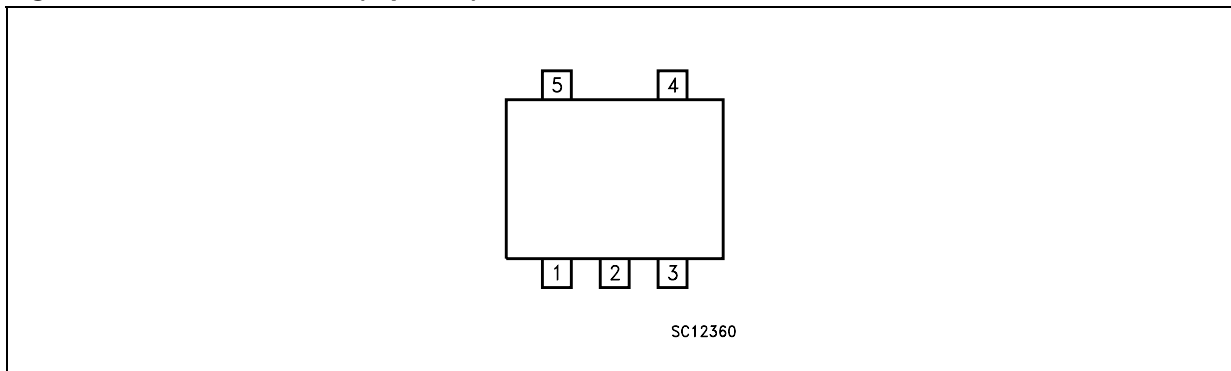


Table 2. Pin description

Pin n°	Symbol	Note
1	SHDN	Shutdown Input: Disables the regulator when 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: Bypass with 0.1 $\mu$ F to improve the $V_{REF}$ thermal noise performances.
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

**Table 5. Electrical characteristics for LK112S** ( $T_J = 25\text{ °C}$ ,  $V_{IN} = V_{OUT} + 1\text{ V}$  <sup>(1)</sup>,  $I_{OUT} = 0\text{ mA}$ ,  $V_{SHDN} = 1.8\text{ V}$ ,  $C_I = 1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$ ,  $C_{BYPASS} = 0.1\text{ }\mu\text{F}$  unless otherwise specified)

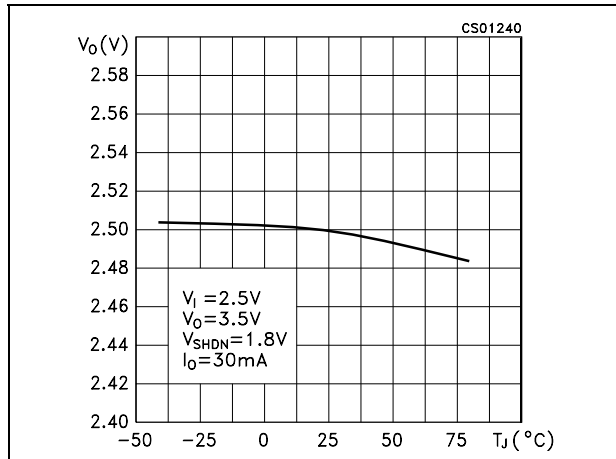
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_d$	Quiescent current	ON MODE (except $I_{SHDN}$ )		175	250	$\mu\text{A}$
		OFF MODE, $V_I = 8\text{V}$ , $V_{SHDN} = 0\text{V}$		0	0.1	$\mu\text{A}$
$V_O$	Output voltage	$I_O = 30\text{mA}$	(see table)			
$\Delta V_O$	Line regulation	$V_I = V_O + 1\text{V}$ 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 $200\text{mA}$		30	90	mV
$V_d$	Dropout voltage	$I_O = 60\text{ mA}$ <sup>(2)</sup>		0.17	0.24	V
		$I_O = 200\text{ mA}$ <sup>(2)</sup>		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 $80\text{kHz}$ , $C_{BYP} = 0.1\text{ }\mu\text{F}$ $C_O = 10\text{ }\mu\text{F}$ , $V_I = V_O + 1.5\text{V}$ , $I_O = 60\text{mA}$		30		$\mu\text{Vrms}$
$I_{SHDN}$	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 version with output voltage less than 2V  $V_{IN} = 2.4\text{V}$
2. Only for version with output voltage more than 2.1V

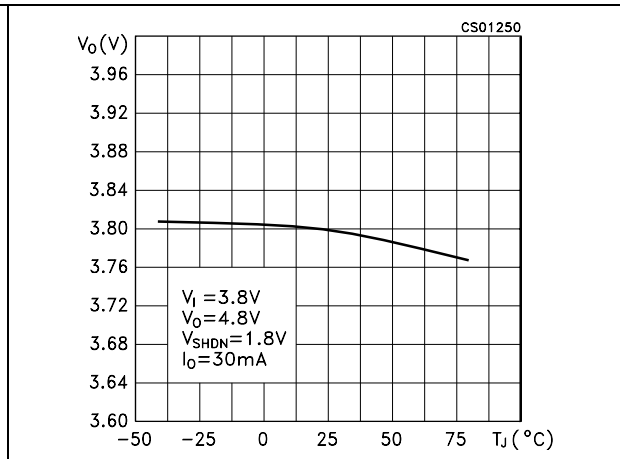
# 5 Typical characteristics

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

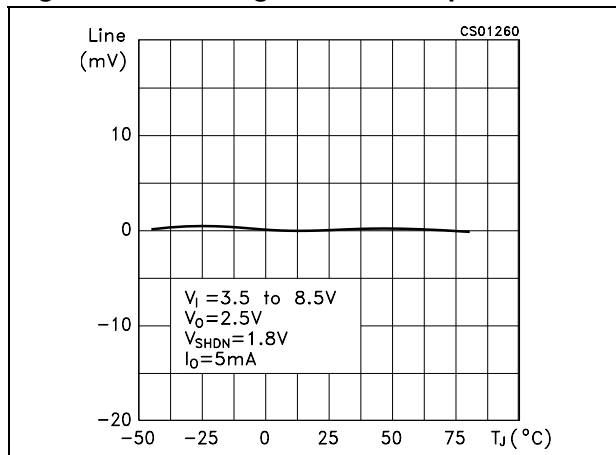
**Figure 3. Output voltage vs temperature**



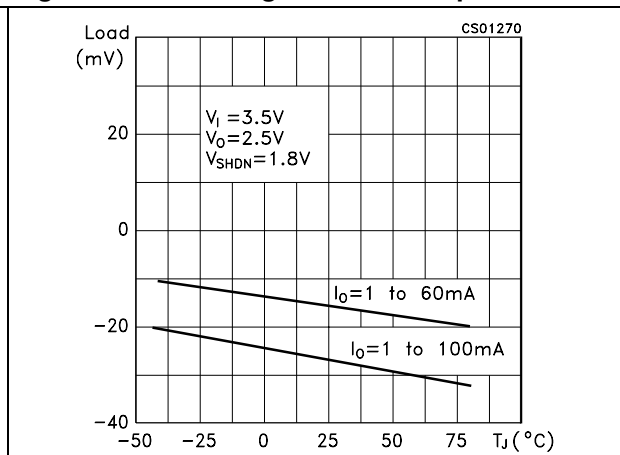
**Figure 4. Output voltage vs temperature**



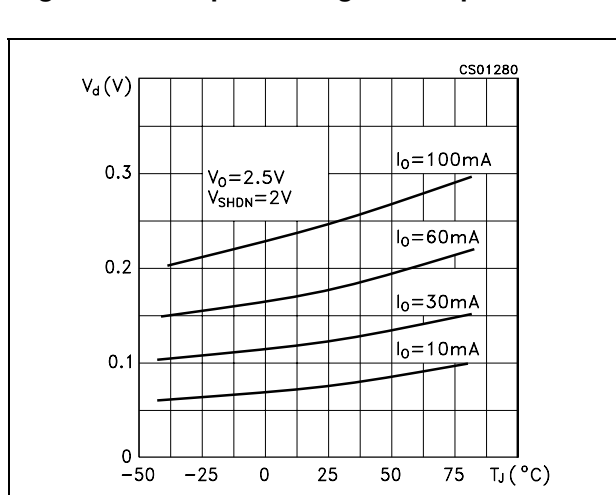
**Figure 5. Line regulation vs temperature**



**Figure 6. Load regulation vs temperature**



**Figure 7. Dropout voltage vs temperature**



**Figure 8. Short circuit current vs dropout voltage**

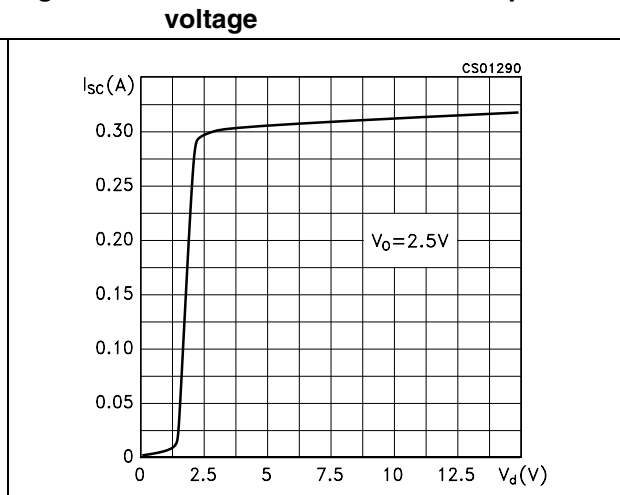


Figure 9. Output voltage vs input voltage

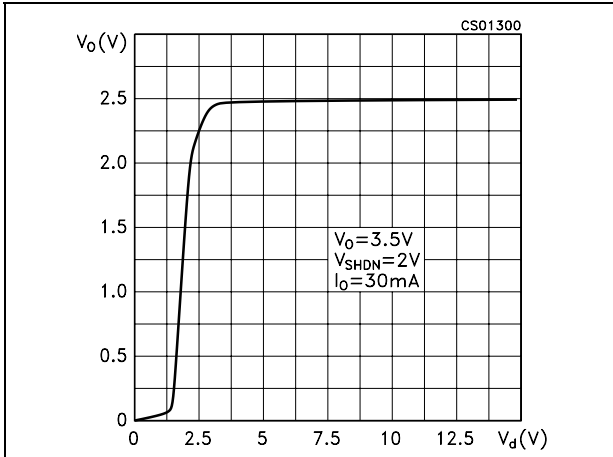


Figure 10. Shutdown voltage vs temperature

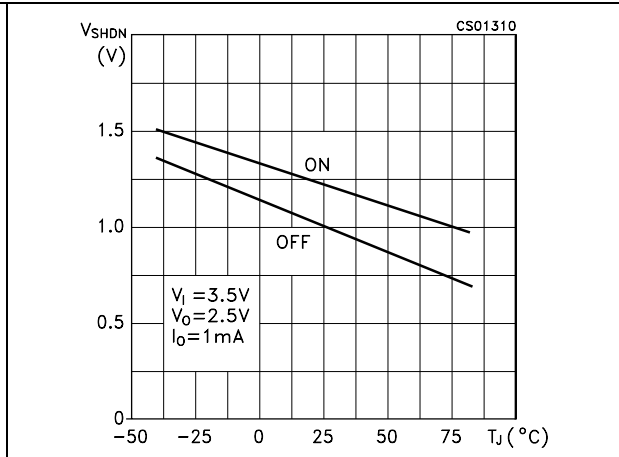


Figure 11. Shutdown current vs shutdown voltage

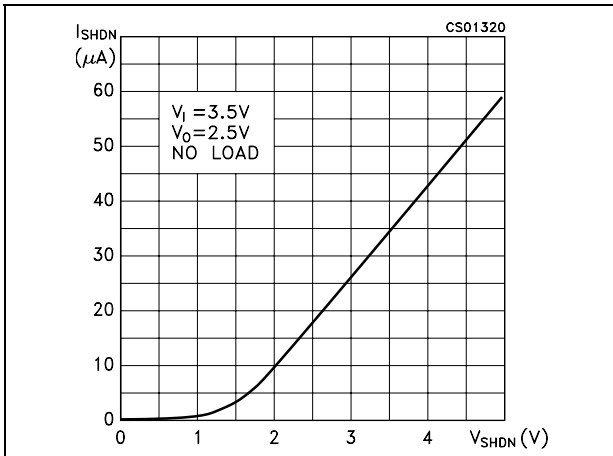


Figure 12. Supply voltage rejection vs temperature

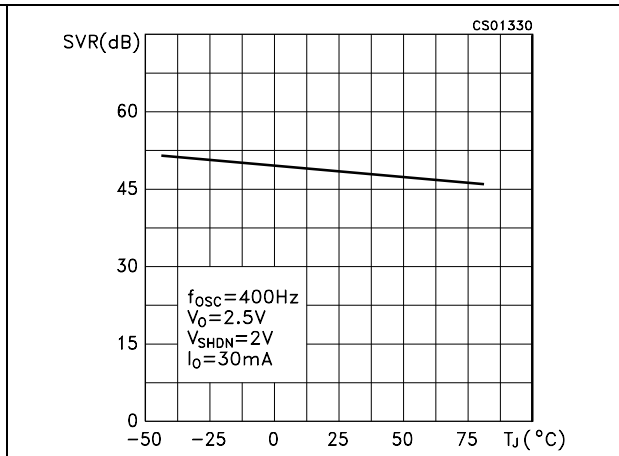


Figure 13. Supply voltage rejection vs output current

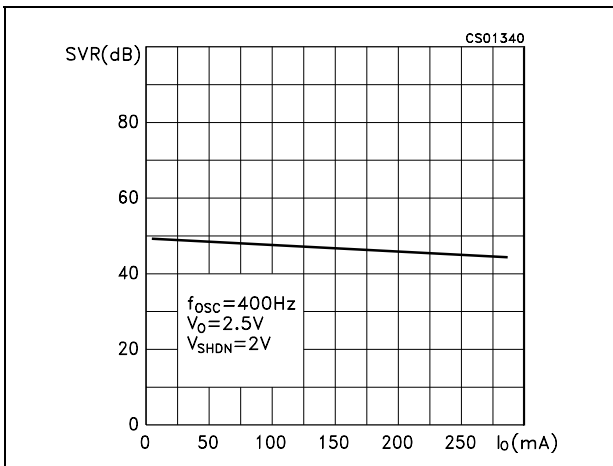


Figure 14. Supply voltage rejection vs frequency

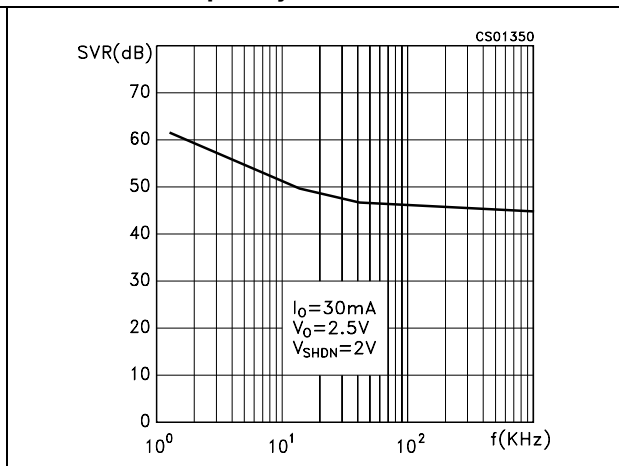




Figure 15. Supply voltage rejection vs temperature

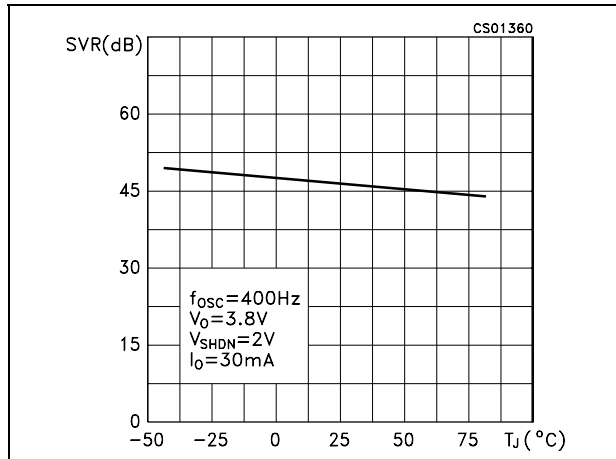


Figure 16. Quiescent current vs temperature

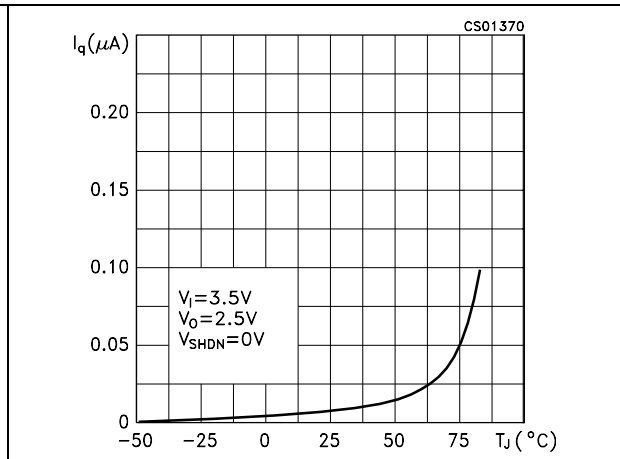


Figure 17. Quiescent current vs input voltage

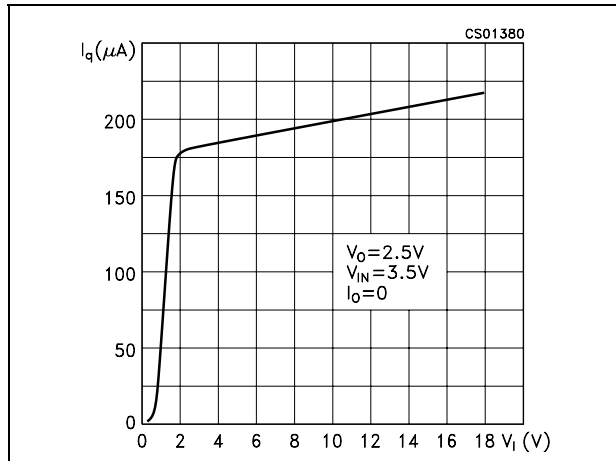


Figure 18. Quiescent current vs shutdown voltage

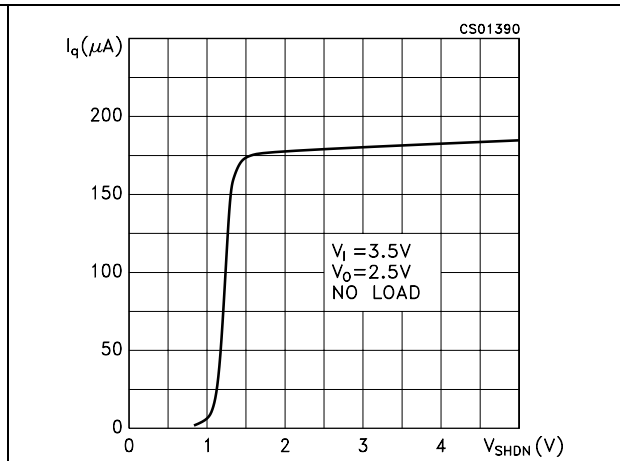


Figure 19. Quiescent current vs temperature

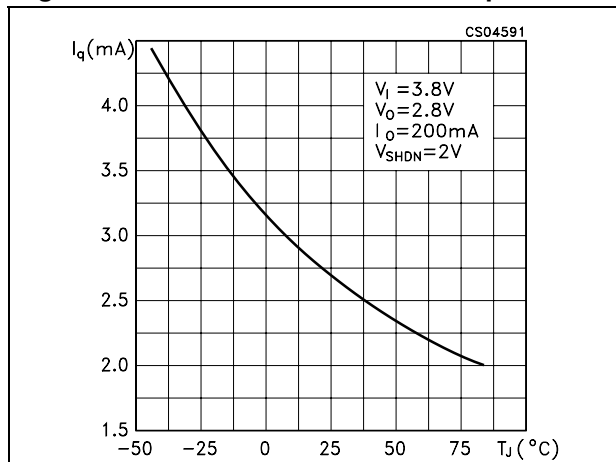


Figure 20. Reverse current vs reverse voltage

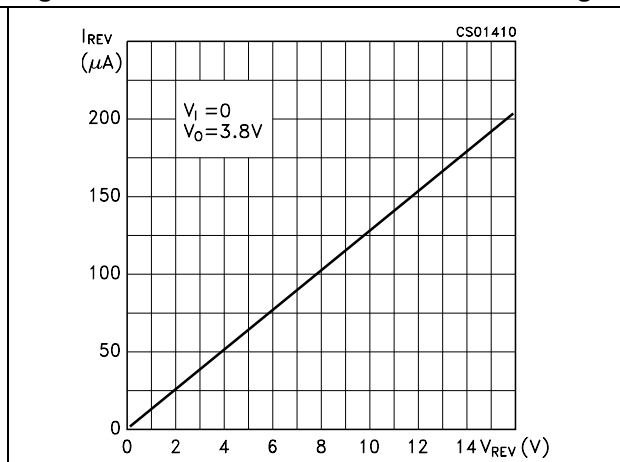


Figure 21. Stability

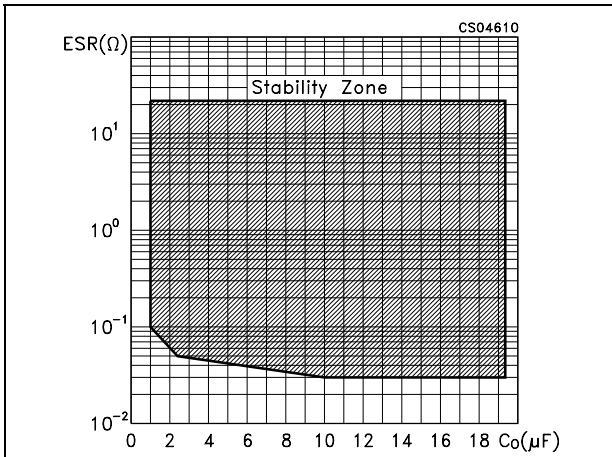


Figure 22. Spectrum noise

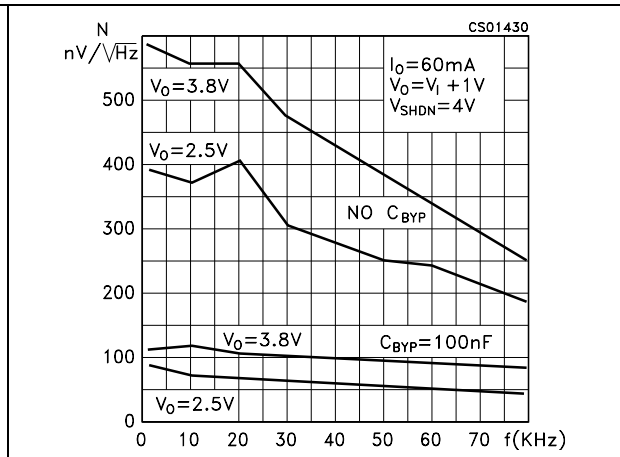


Figure 23. Start-up transient

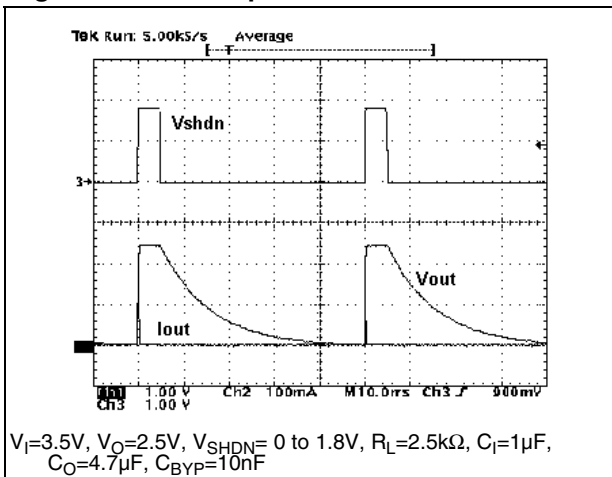


Figure 24. Start-up transient

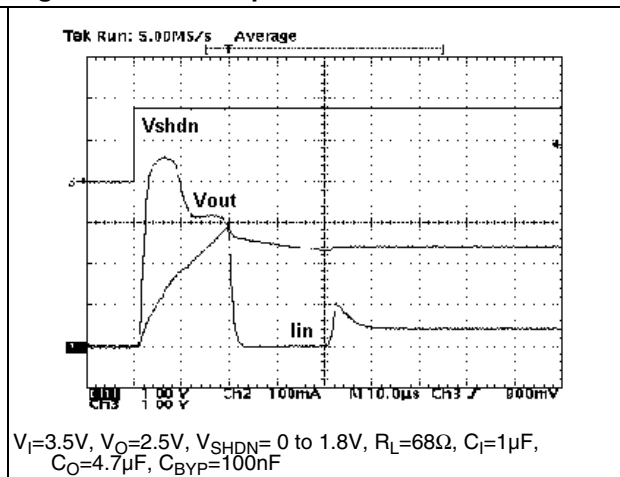


Figure 25. Line transient

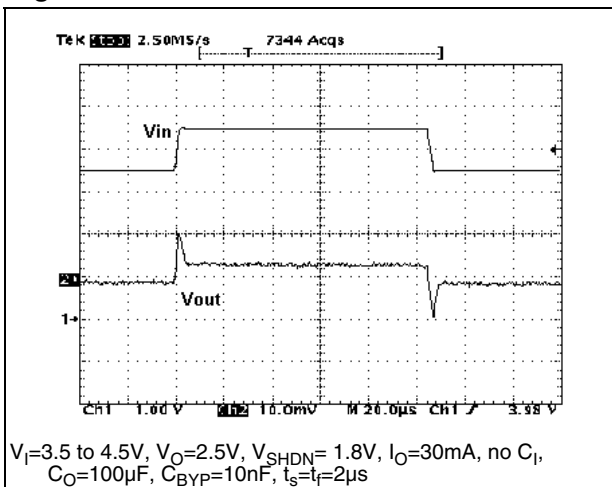


Figure 26. Line transient

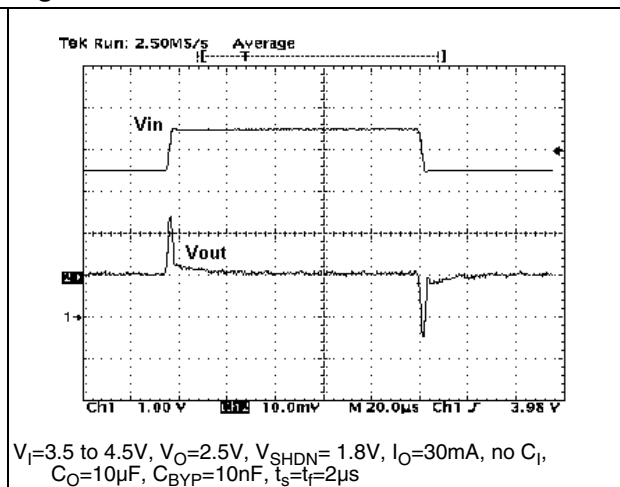


Figure 27. Line transient

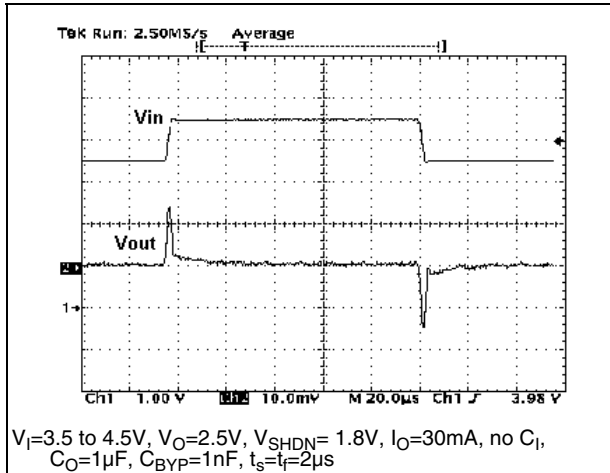


Figure 28. Load transient

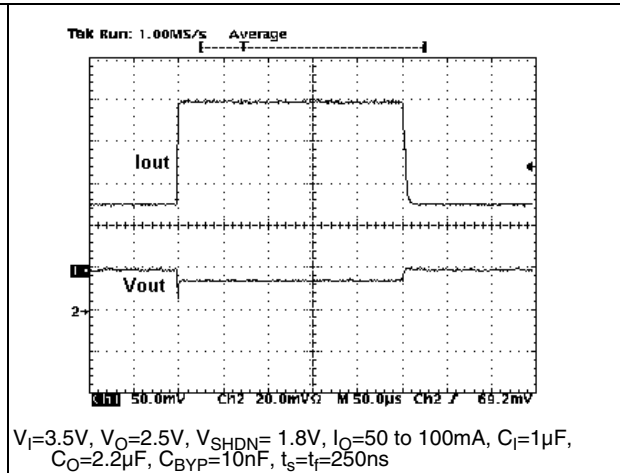


Figure 29. Load transient

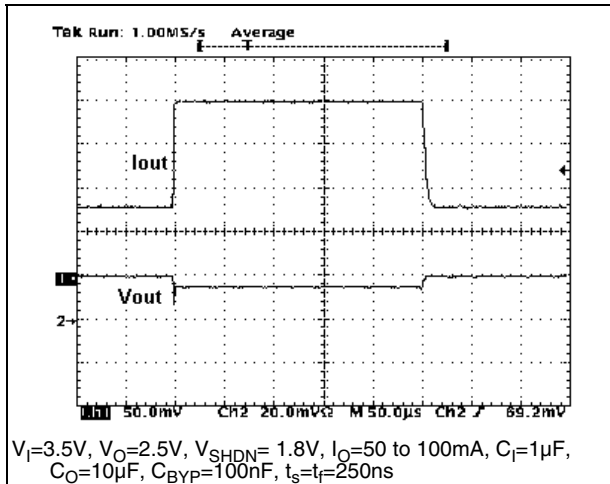
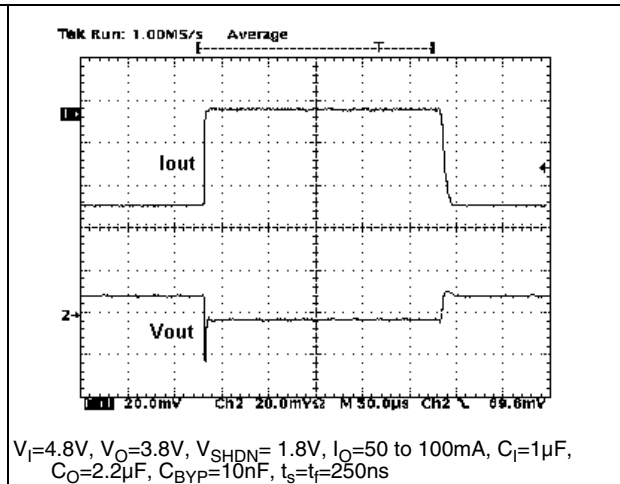


Figure 30. Load transient

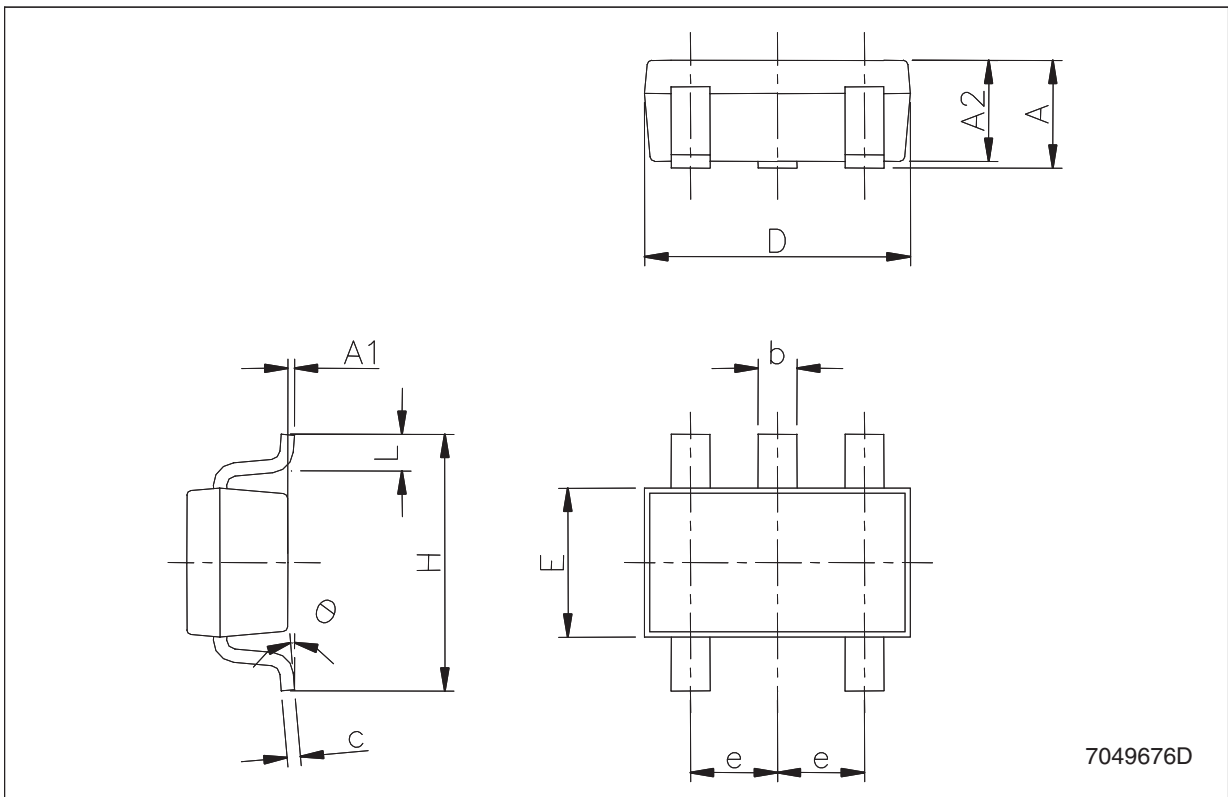


## 6 Package mechanical data

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](http://www.st.com).

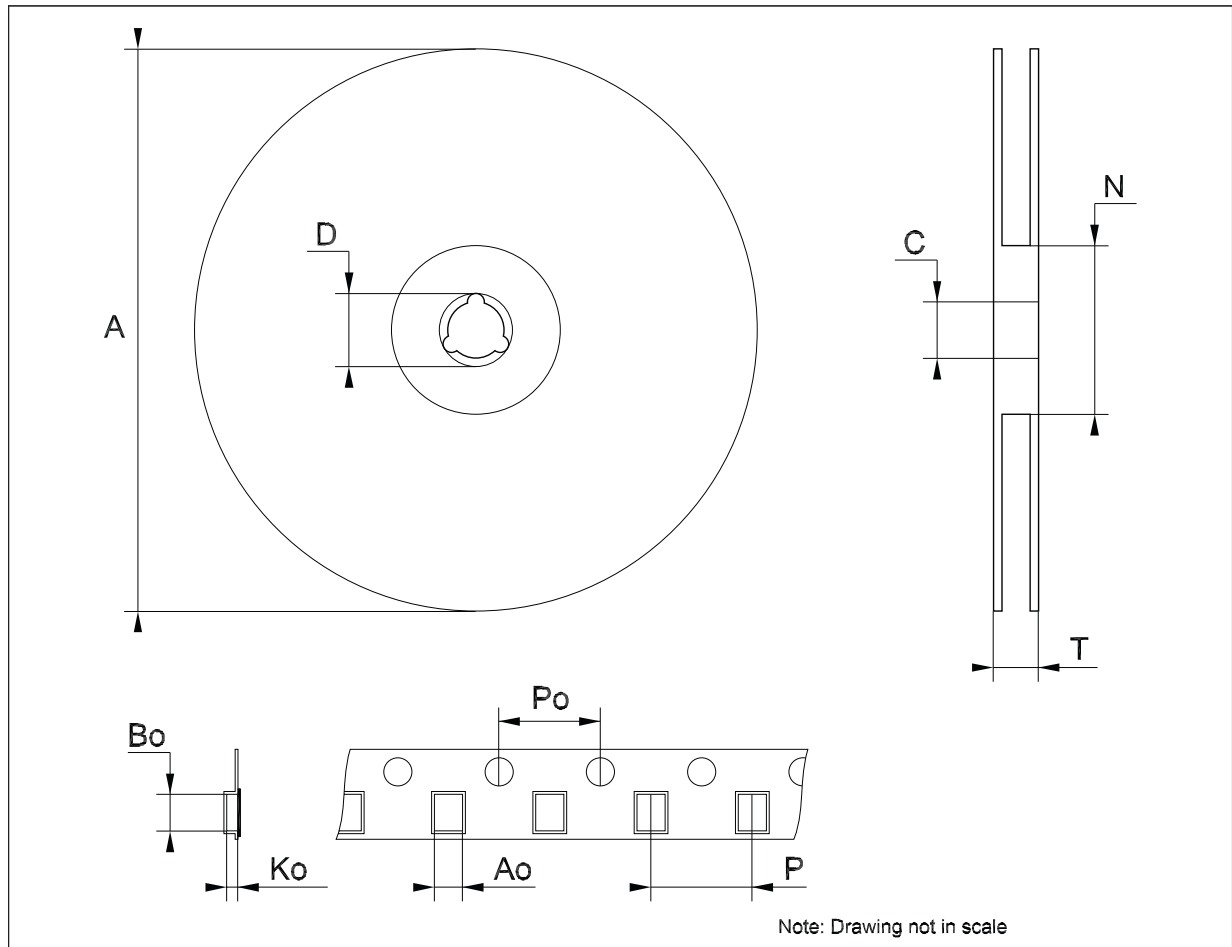
**SOT23-5L mechanical data**

Dim.	mm.			mils.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.90		1.45	35.4		57.1
A1	0.00		0.10	0.0		3.9
A2	0.90		1.30	35.4		51.2
b	0.35		0.50	13.7		19.7
C	0.09		0.20	3.5		7.8
D	2.80		3.00	110.2		118.1
E	1.50		1.75	59.0		68.8
e		0.95			37.4	
H	2.60		3.00	102.3		118.1
L	0.10		0.60	3.9		23.6



**Tape & reel SOT23-xL 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	3.13	3.23	3.33	0.123	0.127	0.131
Bo	3.07	3.17	3.27	0.120	0.124	0.128
Ko	1.27	1.37	1.47	0.050	0.054	0.058
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	3.9	4.0	4.1	0.153	0.157	0.161



## 7 Order codes

Table 6. Order codes

Part number	Output voltage	V <sub>OUT</sub> Min.	V <sub>OUT</sub> Max.	Test voltage
LK112SM13TR <sup>(1)</sup>	1.3V	1.24V	1.36V	2.4V
LK112SM14TR <sup>(1)</sup>	1.4V	1.34V	1.46V	2.4V
LK112SM18TR	1.8V	1.74V	1.86V	2.4V
LK112SM19TR <sup>(1)</sup>	1.9V	1.84V	1.96V	2.4V
LK112SM20TR <sup>(1)</sup>	2.0V	1.94V	2.06V	3.0V
LK112SM21TR <sup>(1)</sup>	2.1V	2.04V	2.16V	3.1V
LK112SM22TR <sup>(1)</sup>	2.2V	2.14V	2.26V	3.2V
LK112SM23TR <sup>(1)</sup>	2.3V	2.24V	2.36V	3.3V
LK112SM24TR <sup>(1)</sup>	2.4V	2.34V	2.46V	3.4V
LK112SM26TR <sup>(1)</sup>	2.6V	2.54V	2.66V	3.6V
LK112SM28TR	2.8V	2.74V	2.86V	3.8V
LK112SM29TR <sup>(1)</sup>	2.9V	2.84V	2.96V	3.9V
LK112SM31TR <sup>(1)</sup>	3.1V	3.04V	3.16V	4.1V
LK112SM33TR	3.3V	3.24V	3.36V	4.3V
LK112SM34TR <sup>(1)</sup>	3.4V	3.335V	3.465V	4.4V
LK112SM35TR <sup>(1)</sup>	3.5V	3.435V	3.565V	4.5V
LK112SM36TR <sup>(1)</sup>	3.6V	3.535V	3.655V	4.6V
LK112SM37TR <sup>(1)</sup>	3.7V	3.630V	3.770V	4.7V
LK112SM38TR <sup>(1)</sup>	3.8V	3.725V	3.875V	4.8V
LK112SM39TR <sup>(1)</sup>	3.9V	3.825V	3.975V	4.9V
LK112SM41TR <sup>(1)</sup>	4.1V	4.020V	4.180V	5.1V
LK112SM42TR <sup>(1)</sup>	4.2V	4.120V	4.280V	5.2V
LK112SM43TR <sup>(1)</sup>	4.3V	4.215V	4.385V	5.3V
LK112SM44TR <sup>(1)</sup>	4.4V	4.315V	4.485V	5.4V
LK112SM45TR <sup>(1)</sup>	4.5V	4.410V	4.590V	5.5V
LK112SM46TR <sup>(1)</sup>	4.6V	4.510V	4.690V	5.6V
LK112SM47TR <sup>(1)</sup>	4.7V	4.605V	4.795V	5.7V
LK112SM48TR <sup>(1)</sup>	4.8V	4.705V	4.895V	5.8V
LK112SM49TR <sup>(1)</sup>	4.9V	4.800V	5.000V	5.9V
LK112SM50TR	5.0V	4.900V	5.100V	6.0V

1. Available on request.

## 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 <sub>OP</sub> value on table 2 updated.
20-Jul-2007	7	Add <a href="#">Table 1</a> in cover page.
21-Sep-2007	8	Features updated.
11-Dec-2007	9	Modified: <a href="#">Table 6</a> .
12-Feb-2008	10	Modified: <a href="#">Table 6 on page 15</a> .
10-Jul-2008	11	Modified: <a href="#">Table 1 on page 1</a> and <a href="#">Table 6 on page 15</a> .



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