

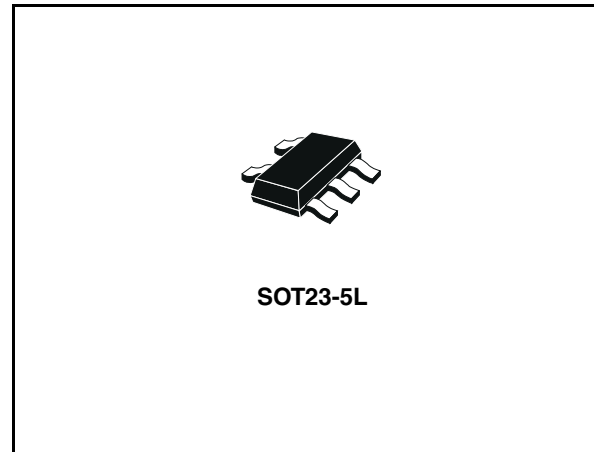
Low noise low drop voltage regulator with shutdown function

Features

- Output current up to 150 mA
- Low dropout voltage (350 mV at $I_{OUT} = 50$ mA)
- Very low quiescent current: 0.1 μ A in OFF mode and max. 250 μ A in ON mode at $I_{OUT} = 0$ mA
- Low output noise: typ 30 μ V at $I_{OUT} = 60$ mA and 10 Hz < f < 80 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 LK112xx 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 μ Vrms. An internal PNP pass transistor is used to achieve a low dropout voltage.



The LK112xx 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

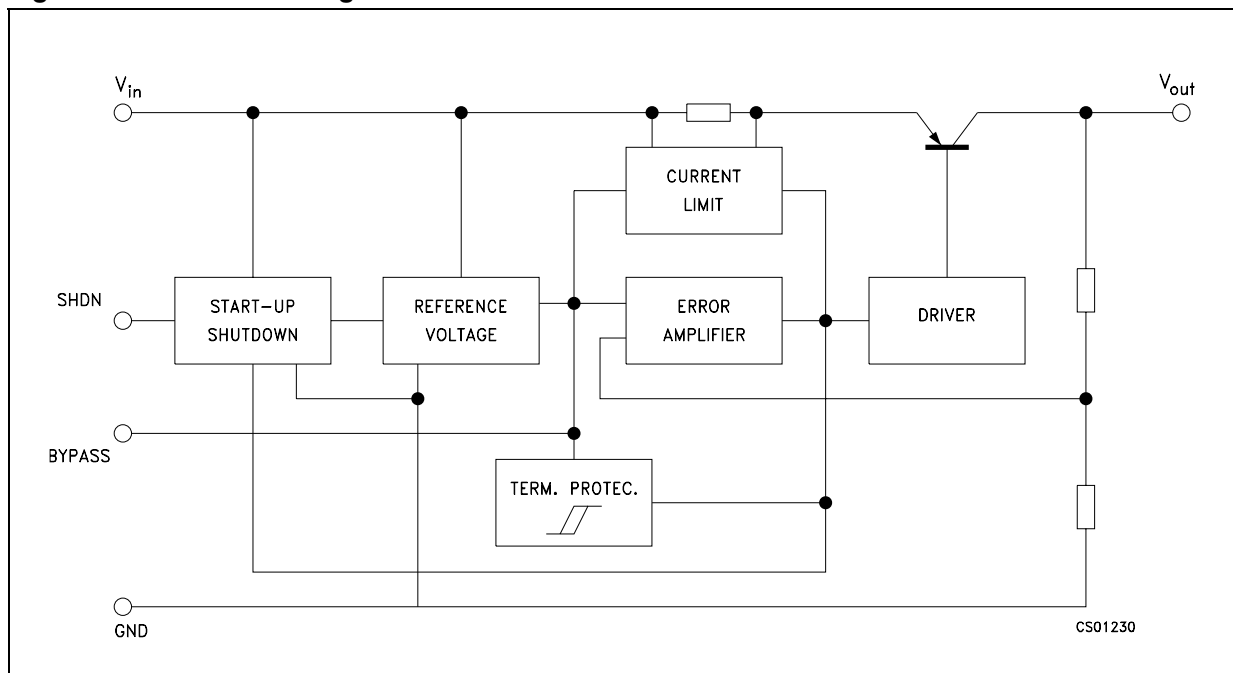
Part numbers			
LK112XX14	LK112XX24	LK112XX35	LK112XX45
LK112XX15	LK112XX25	LK112XX37	LK112XX46
LK112XX18	LK112XX26	LK112XX39	LK112XX48
LK112XX19	LK112XX29	LK112XX41	LK112XX49
LK112XX20	LK112XX31	LK112XX42	LK112XX50
LK112XX22	LK112XX33	LK112XX43	LK112XX60
LK112XX23	LK112XX34	LK112XX44	LK112XX80

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1 Diagram

Figure 1. Schematic diagram



2 Pin configuration

Figure 2. Pin connection (top view)

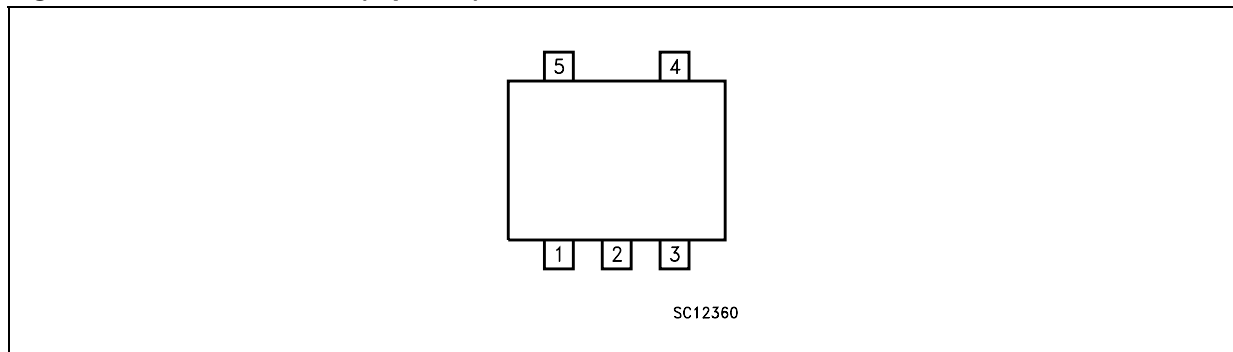


Table 2. Pin description

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 μ 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 LK112 ($T_J = 25\text{ }^\circ\text{C}$, $V_{IN} = V_{OUT} + 1\text{ V}$ ⁽¹⁾, $I_{OUT} = 0\text{ mA}$, $V_{SHDN} = 1.8\text{ V}$, $C_I = 1\text{ }\mu\text{F}$, $C_O = 2.2\text{ }\mu\text{F}$, $C_{BYPASS} = 0.1\text{ }\mu\text{F}$ unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_q	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	$I_O = 30\text{mA}$	(see table)			
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 60mA		15	30	mV
		$I_O = 1$ to 150mA		25	90	mV
V_d	Dropout voltage	$I_O = 60\text{ mA}$ ⁽²⁾		0.17	0.24	V
		$I_O = 150\text{ mA}$ ⁽²⁾		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		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 version with output voltage less than 2 V, $V_{IN} = 2.4\text{ V}$
2. Only for version with output voltage more than 2.1 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

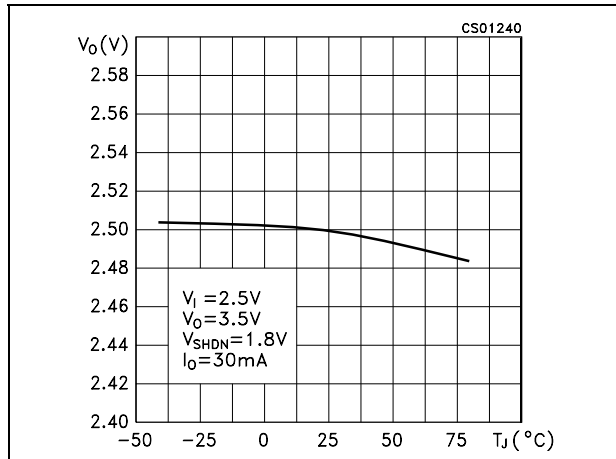


Figure 4. Output voltage vs temperature

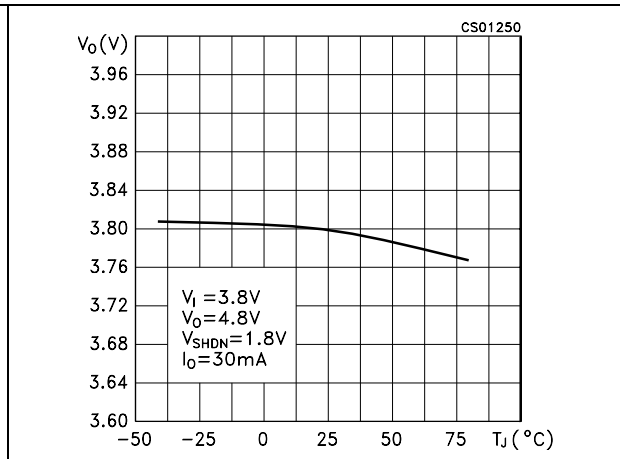


Figure 5. Line regulation vs temperature

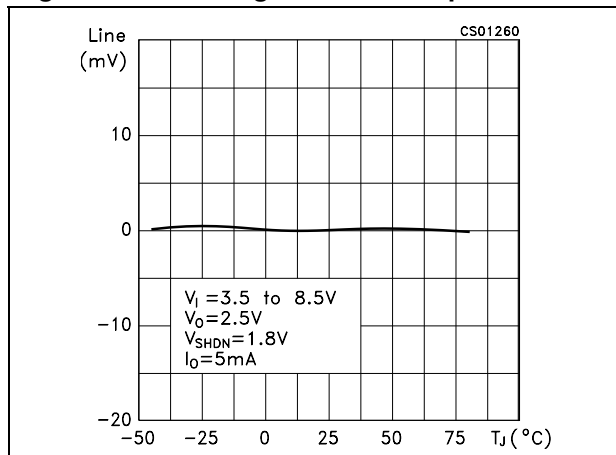


Figure 6. Load regulation vs temperature

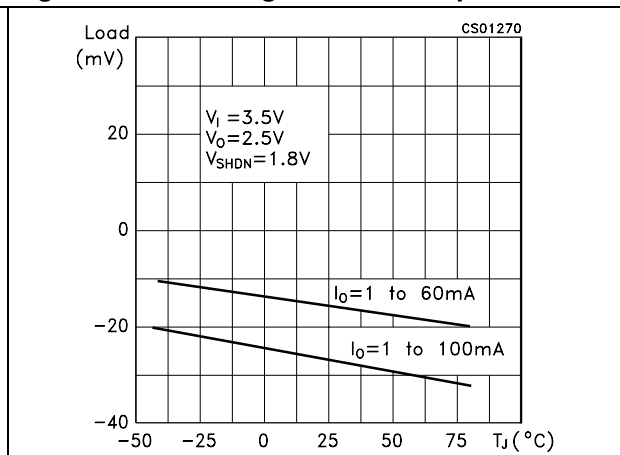


Figure 7. Dropout voltage vs temperature

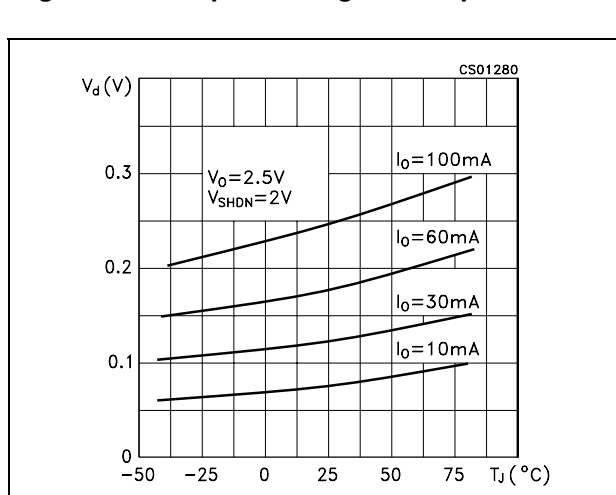


Figure 8. Short circuit current vs dropout voltage

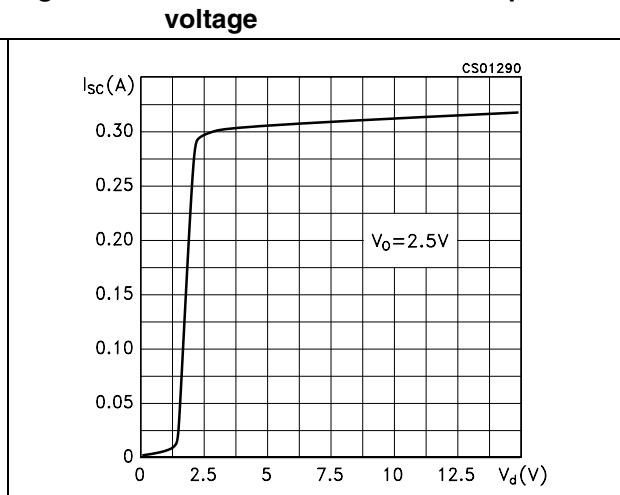


Figure 9. Output voltage vs input voltage

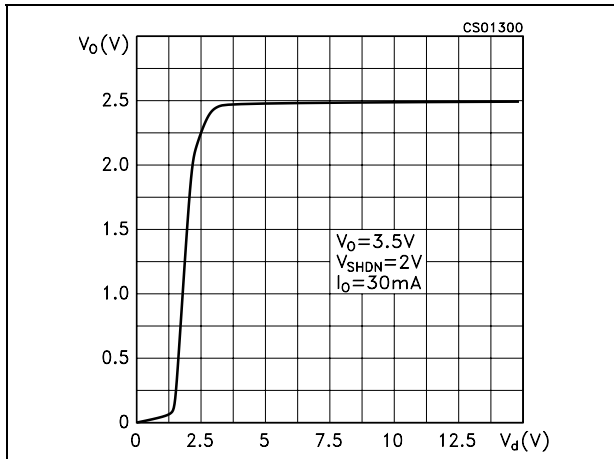


Figure 10. Shutdown voltage vs temperature

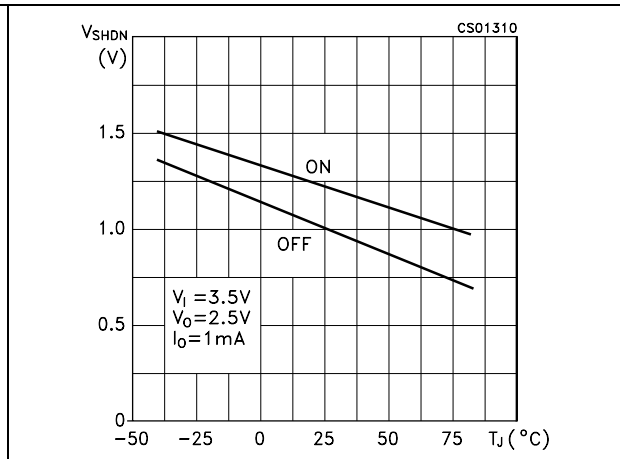


Figure 11. Shutdown current vs shutdown voltage

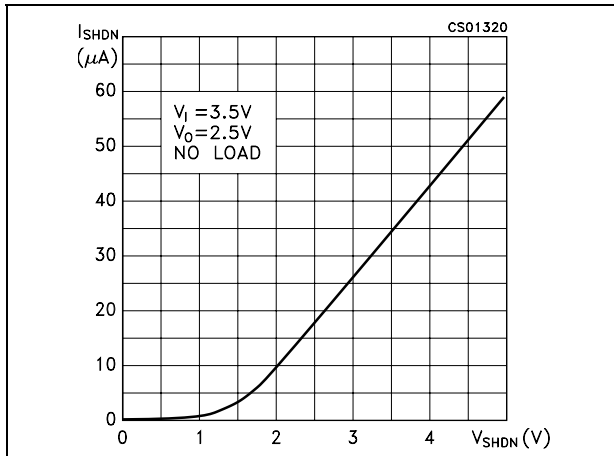


Figure 12. Supply voltage rejection vs temperature

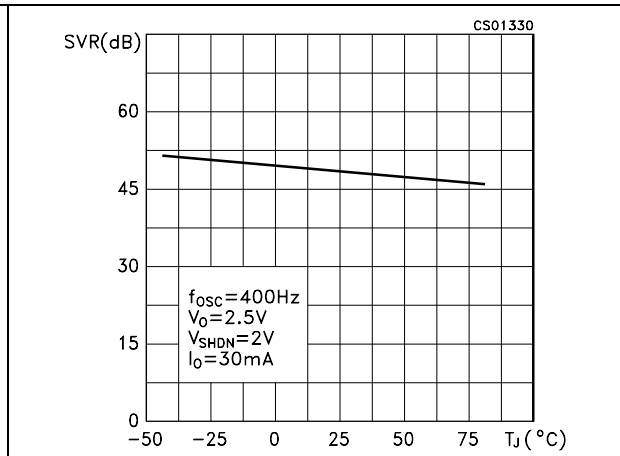


Figure 13. Supply voltage rejection vs output current

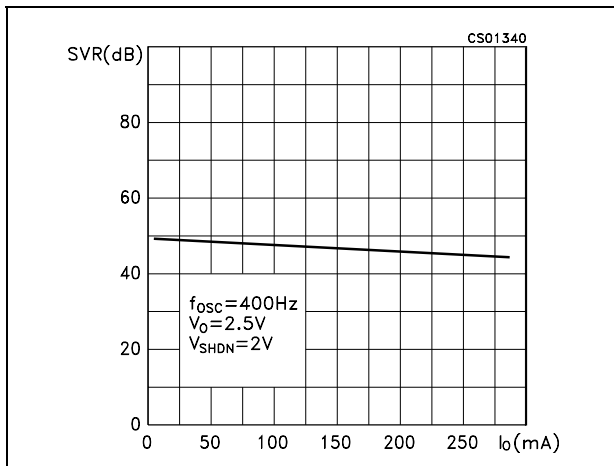


Figure 14. Supply voltage rejection vs frequency

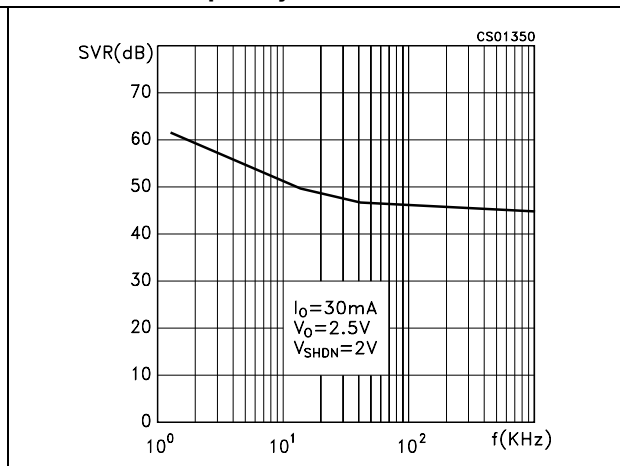


Figure 15. Supply voltage rejection vs temperature

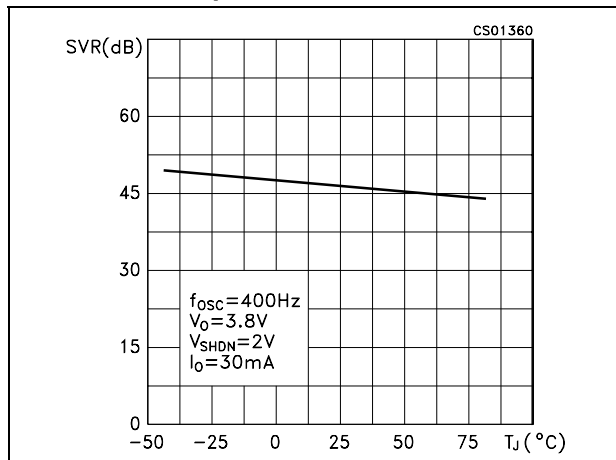


Figure 16. Quiescent current vs temperature

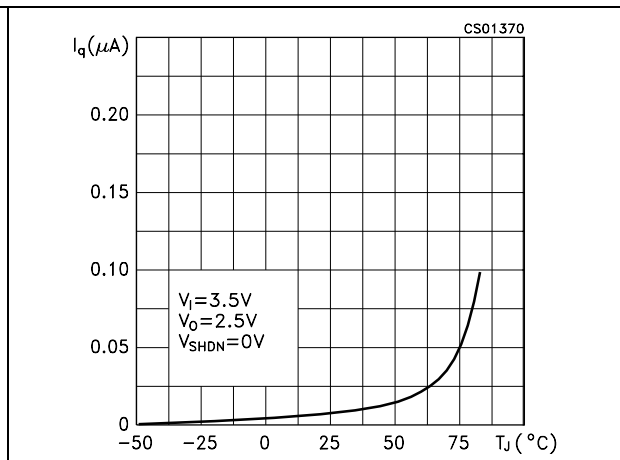


Figure 17. Quiescent current vs input voltage

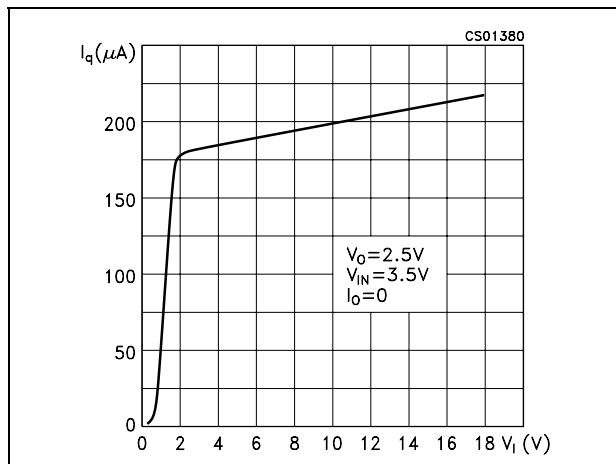


Figure 18. Quiescent current vs shutdown voltage

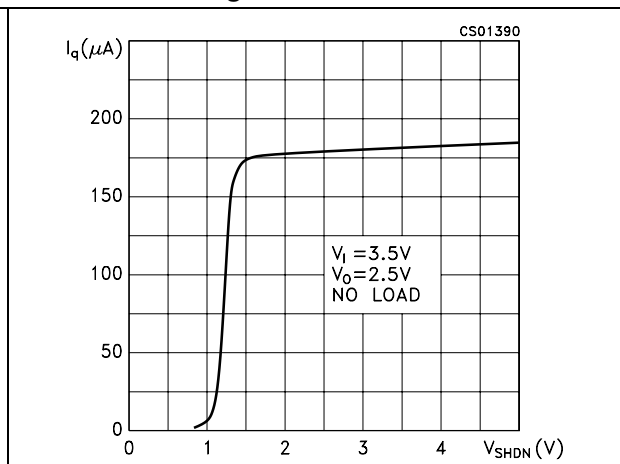


Figure 19. Quiescent current vs output current

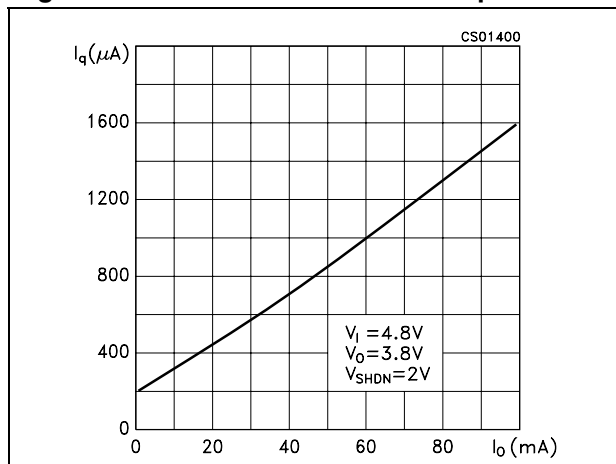


Figure 20. Reverse current vs reverse voltage

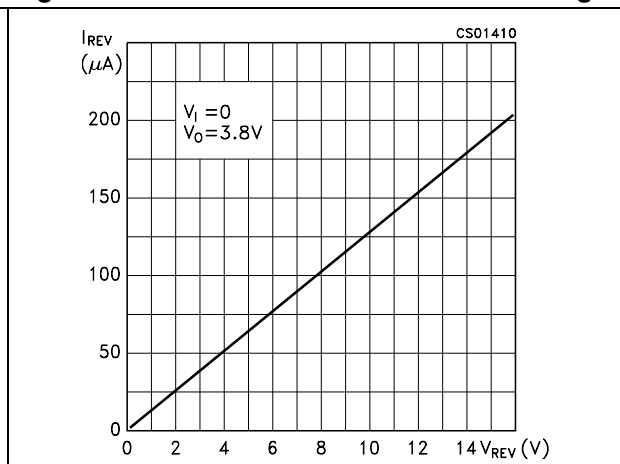


Figure 21. Stability

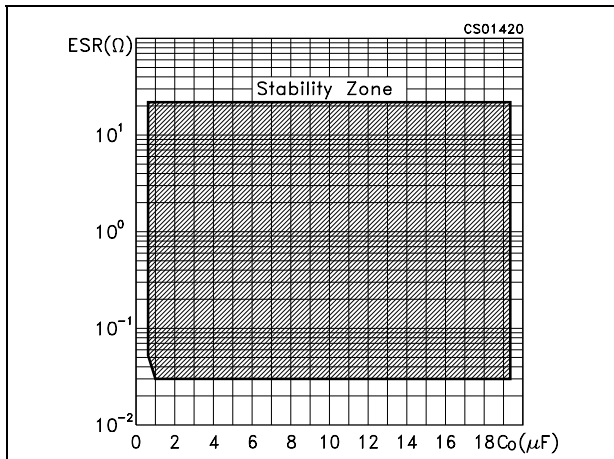


Figure 22. Spectrum noise

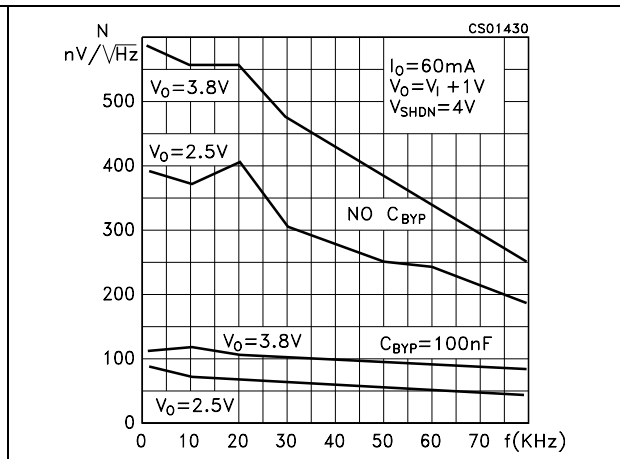


Figure 23. Start-up transient

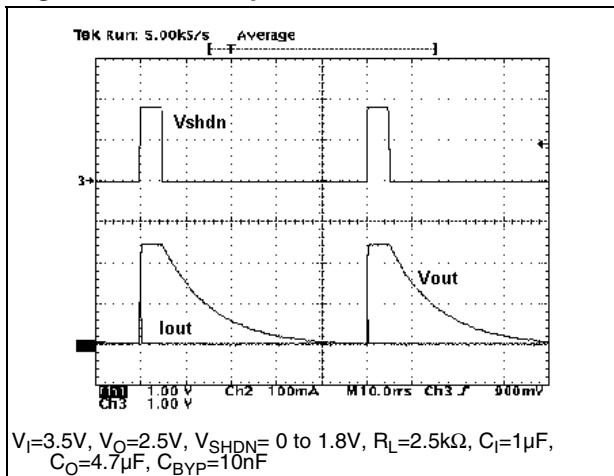


Figure 24. Start-up transient

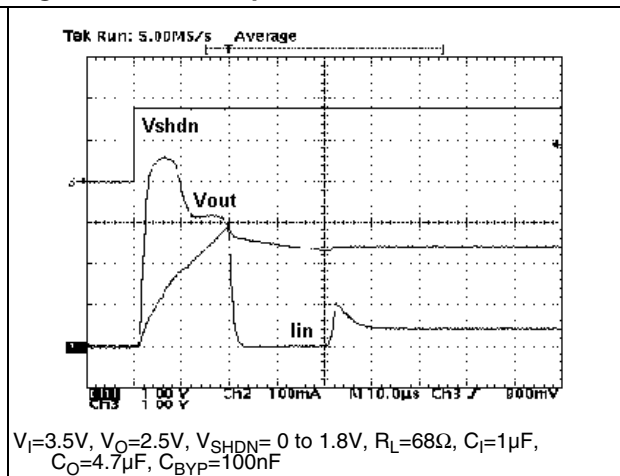


Figure 25. Line transient

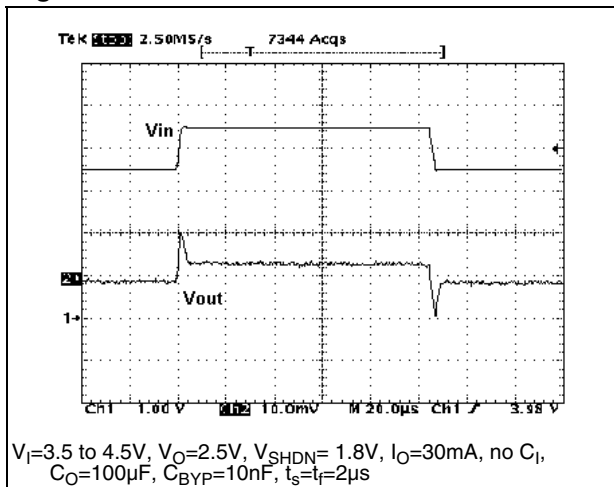


Figure 26. Line transient

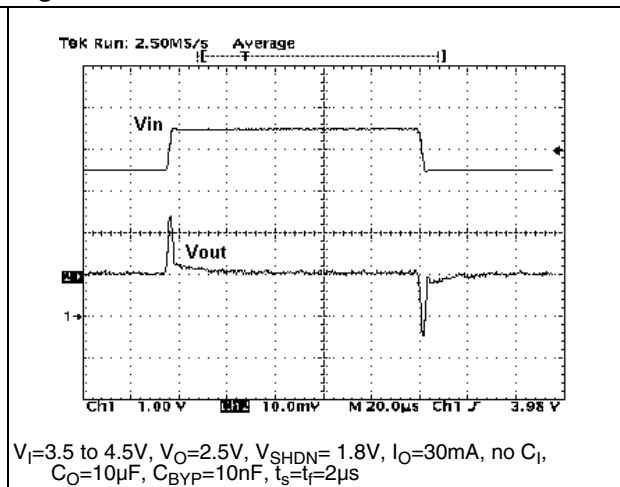


Figure 27. Line transient

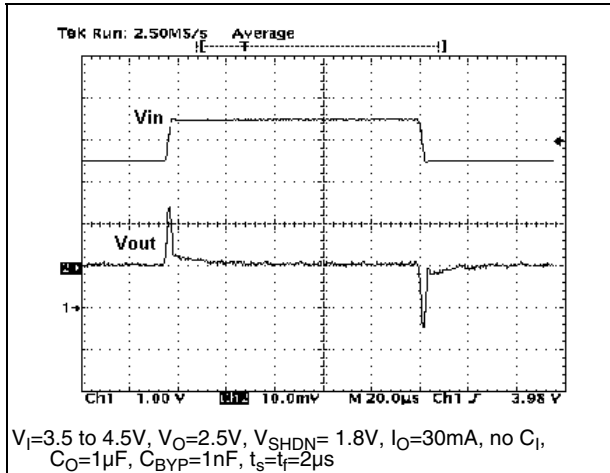


Figure 28. Load transient

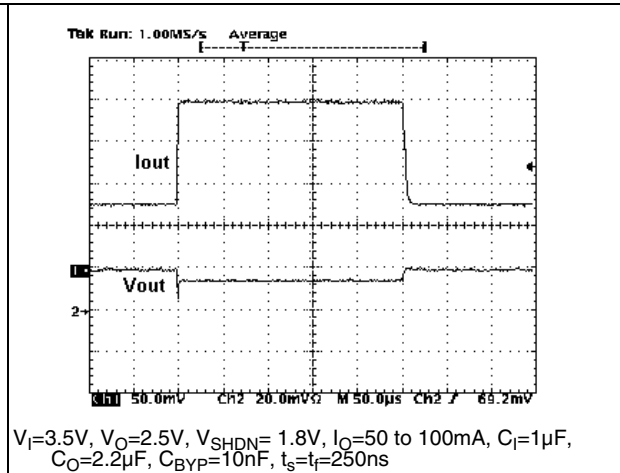


Figure 29. Load transient

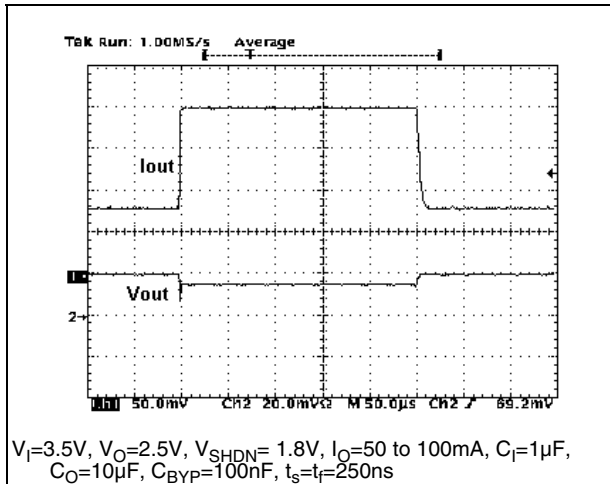
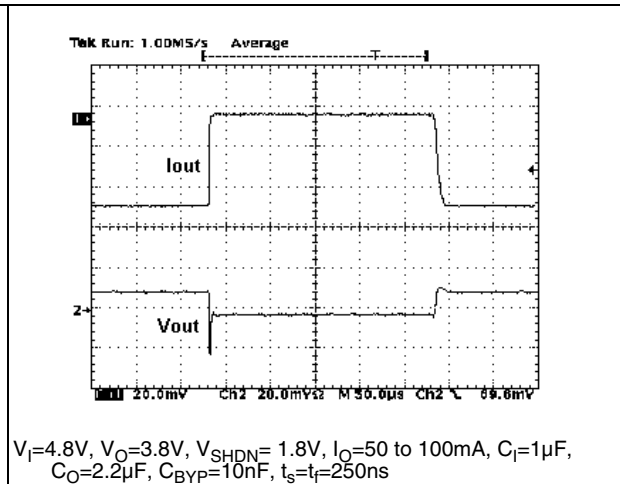


Figure 30. Load transient

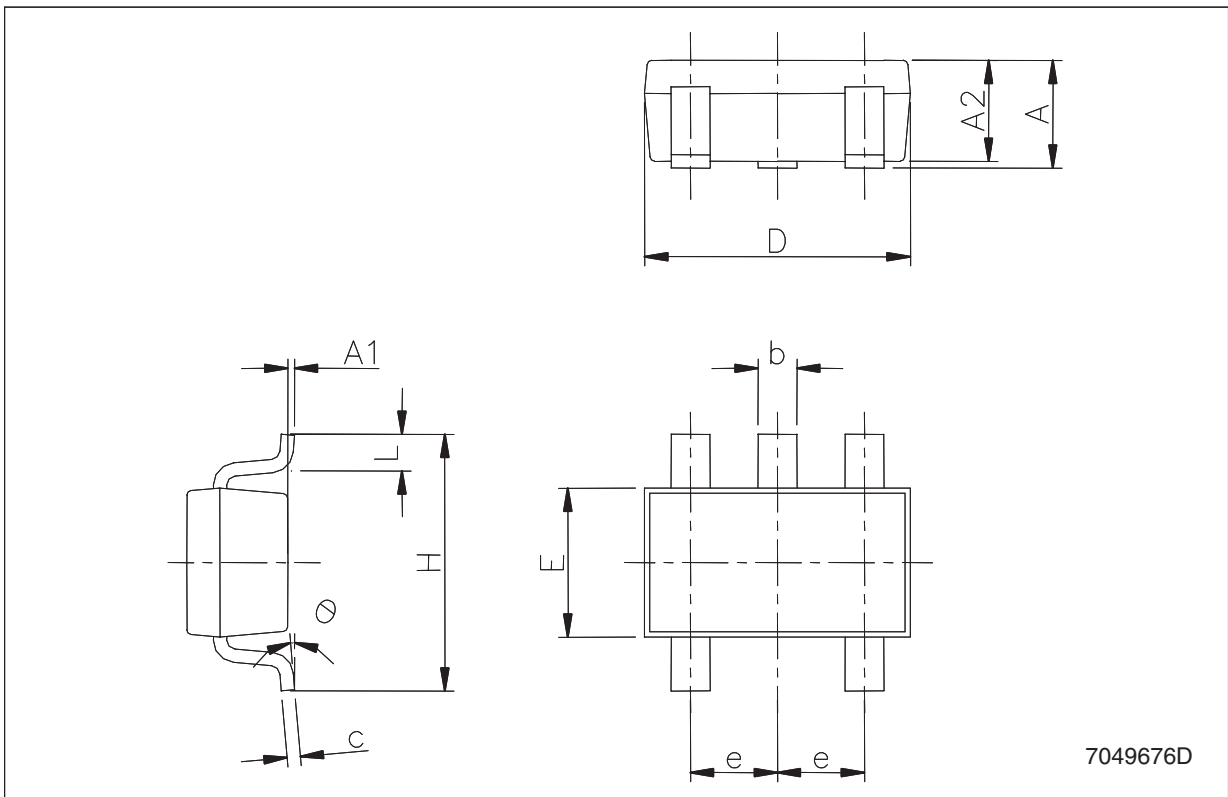


6 Package mechanical data

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.

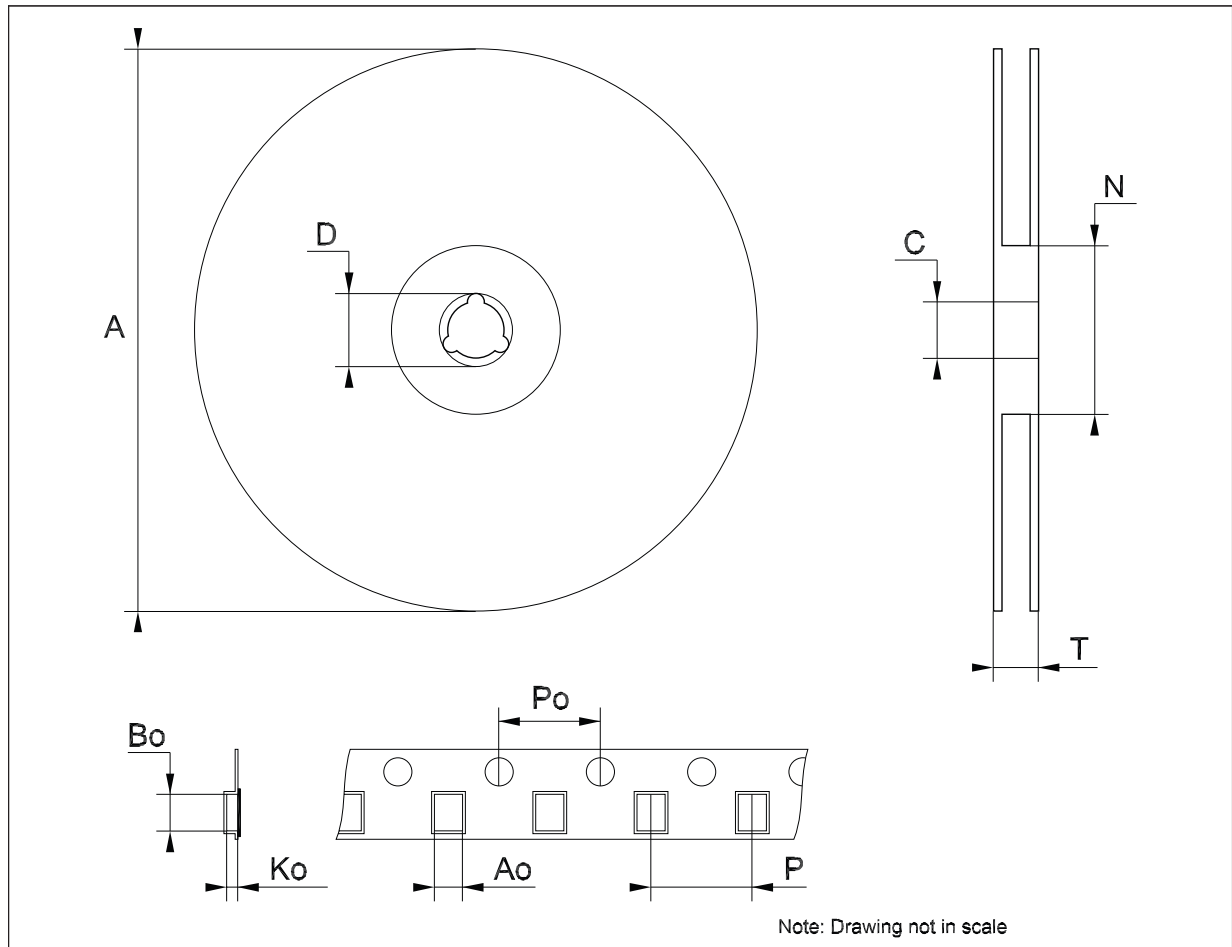
SOT23-5L mechanical data

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 _{OUT} Min	V _{OUT} Max	Test voltage
LK112M14TR ⁽¹⁾	1.4V	1.34V	1.46V	2.4V
LK112M15TR	1.5V	1.44V	1.56V	2.4V
LK112M18TR	1.8V	1.74V	1.86V	2.4V
LK112M19TR ⁽¹⁾	1.9V	1.84V	1.96V	2.4V
LK112M20TR ⁽¹⁾	2.0V	1.94V	2.06V	3.0V
LK112M22TR ⁽¹⁾	2.2V	2.14V	2.26V	3.2V
LK112M23TR ⁽¹⁾	2.3V	2.24V	2.36V	3.3V
LK112M24TR ⁽¹⁾	2.4V	2.34V	2.46V	3.4V
LK112M25TR	2.5V	2.44V	2.56V	3.5V
LK112M26TR ⁽¹⁾	2.6V	2.54V	2.66V	3.6V
LK112M29TR ⁽¹⁾	2.9V	2.84V	2.96V	3.9V
LK112M31TR ⁽¹⁾	3.1V	3.04V	3.16V	4.1V
LK112M33TR	3.3V	3.24V	3.36V	4.3V
LK112M34TR ⁽¹⁾	3.4V	3.335V	3.465V	4.4V
LK112M35TR ⁽¹⁾	3.5V	3.435V	3.565V	4.5V
LK112M37TR ⁽¹⁾	3.7V	3.630V	3.770V	4.7V
LK112M39TR ⁽¹⁾	3.9V	3.825V	3.975V	4.9V
LK112M41TR ⁽¹⁾	4.1V	4.020V	4.180V	5.1V
LK112M42TR ⁽¹⁾	4.2V	4.120V	4.280V	5.2V
LK112M43TR ⁽¹⁾	4.3V	4.215V	4.385V	5.3V
LK112M44TR ⁽¹⁾	4.4V	4.315V	4.485V	5.4V
LK112M45TR ⁽¹⁾	4.5V	4.410V	4.590V	5.5V
LK112M46TR ⁽¹⁾	4.6V	4.510V	4.690V	5.6V
LK112M48TR ⁽¹⁾	4.8V	4.705V	4.895V	5.8V
LK112M49TR ⁽¹⁾	4.9V	4.800V	5.000V	5.9V
LK112M50TR	5.0V	4.900V	5.100V	6.0V
LK112M60TR	6.0V	5.880V	6.120V	7.0V
LK112M80TR	8.0V	7.840V	8.160V	9.0V

1. Available on request.

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 _{OP} value on table 2 has been updated.
18-Jul-2007	11	Add Table 1 in cover page.
21-Sep-2007	12	Features updated.
11-Dec-2007	13	Modified: Table 6 .
12-Feb-2008	14	Modified: Table 6 on page 15 .
10-Jul-2008	15	Modified: Table 1 on page 1 and Table 6 on page 15 .

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