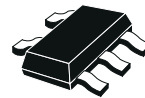


## Low noise low drop voltage regulator with shutdown function

### Features

- Output current up to 150 mA
- Low dropout voltage (350 mV at  $I_{OUT} = 50$  mA)
- Very low quiescent current:
  - 0.1  $\mu$ 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)



SOT23-5L

### 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  $\mu$ 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 |           |           |           |
|--------------|-----------|-----------|-----------|
| LK112XX15    | LK112XX25 | LK112XX50 | LK112XX60 |
| LK112XX18    | LK112XX33 | LK112XX55 | LK112XX80 |

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3      **Maximum ratings ..... 5**

4      **Electrical characteristics ..... 6**

5      **Typical characteristics ..... 7**

6      **Package mechanical data ..... 12**

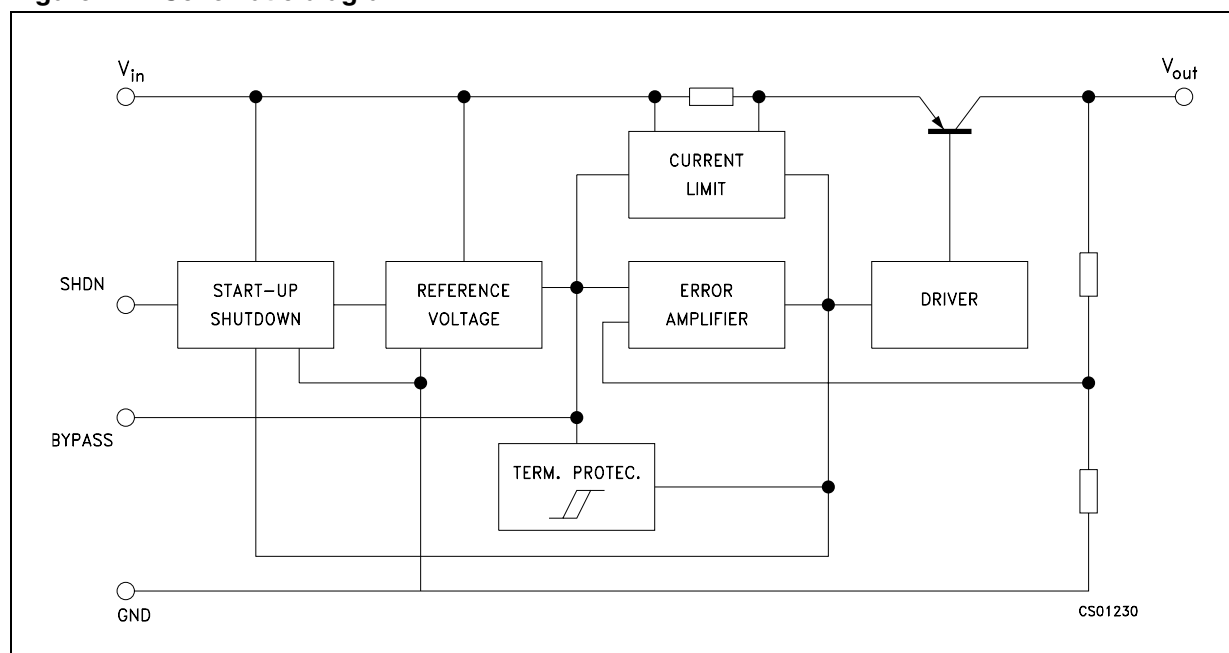
7      **Order codes ..... 15**

8      **Revision history ..... 16**



# 1 Diagram

Figure 1. Schematic diagram



## 2 Pin configuration

Figure 2. Pin connection (top view)

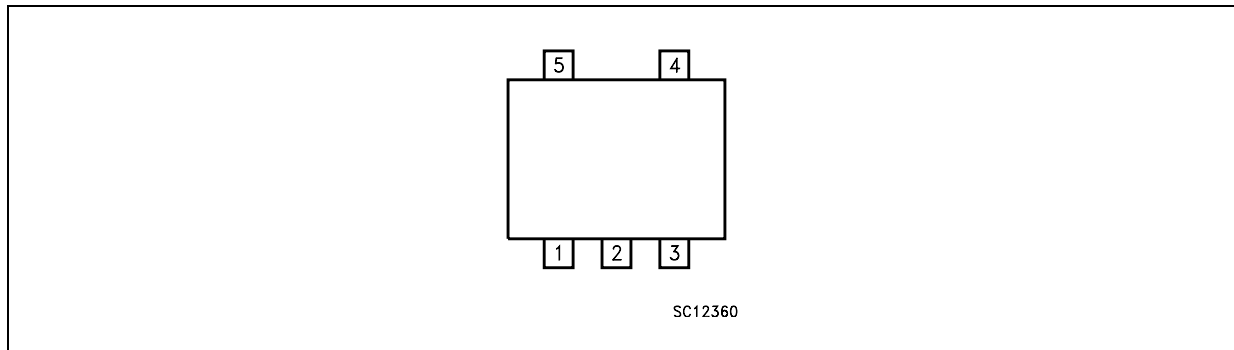


Table 2. Pin description

| 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

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

**Table 5. Electrical characteristics for LK112**

| 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                         | $I_O = 30\text{ mA}$                                                                                                                                            | (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 $150\text{ mA}$                                                                                                                                    |             | 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               | $V_I = V_O + 1.5\text{ V}$ , $C_{BYP} = 0.1\text{ }\mu\text{F}$<br>$C_O = 10\text{ }\mu\text{F}$ , $f = 400\text{ Hz}$ , $I_O = 30\text{ mA}$                   |             | 55   |      | dB                         |
| eN               | Output noise voltage                   | $B = 10\text{ Hz}$ to $80\text{ kHz}$ , $C_{BYP} = 0.1\text{ }\mu\text{F}$<br>$C_O = 10\text{ }\mu\text{F}$ , $V_I = V_O + 1.5\text{ V}$ , $I_O = 60\text{ mA}$ |             | 30   |      | $\mu\text{V}_{\text{rms}}$ |
| $I_{SHDN}$       | 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/ $^{\circ}\text{C}$     |

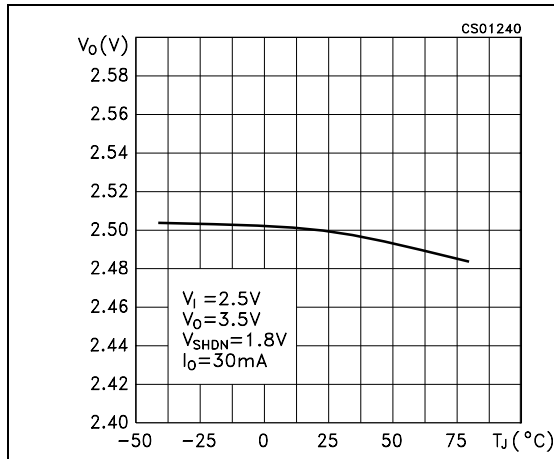
1. Only for version with output voltage more than 2.1 V

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

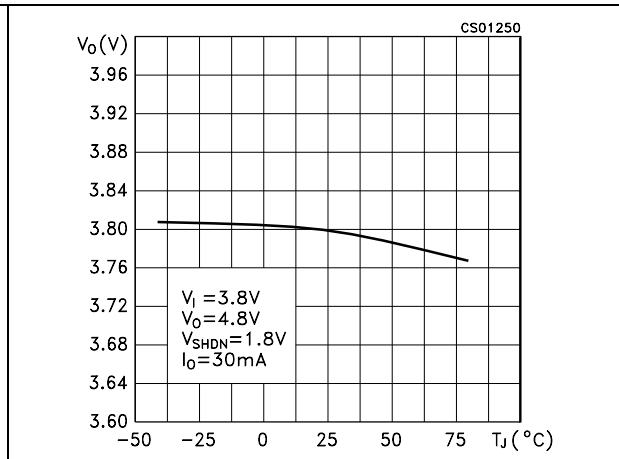
## 5 Typical characteristics

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

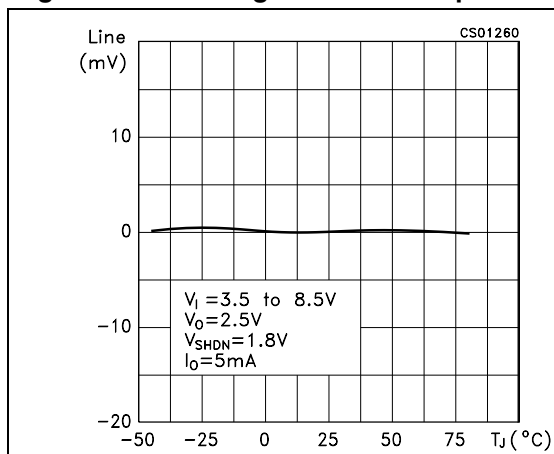
**Figure 3. Output voltage vs. temperature**



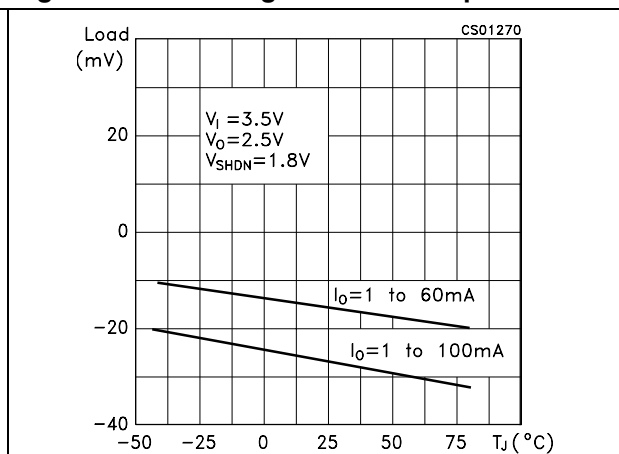
**Figure 4. Output voltage vs. temperature**



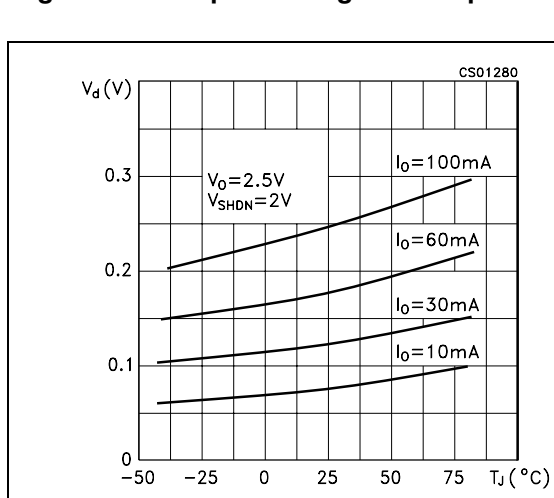
**Figure 5. Line regulation vs. temperature**



**Figure 6. Load regulation vs. temperature**



**Figure 7. Dropout voltage vs. temperature**



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

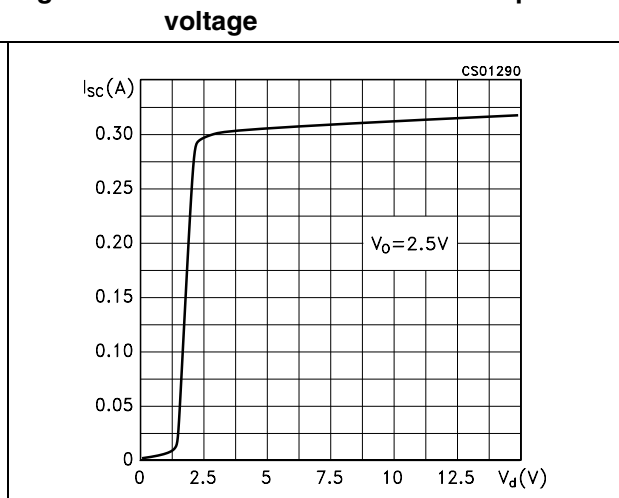


Figure 9. Output voltage vs. input voltage

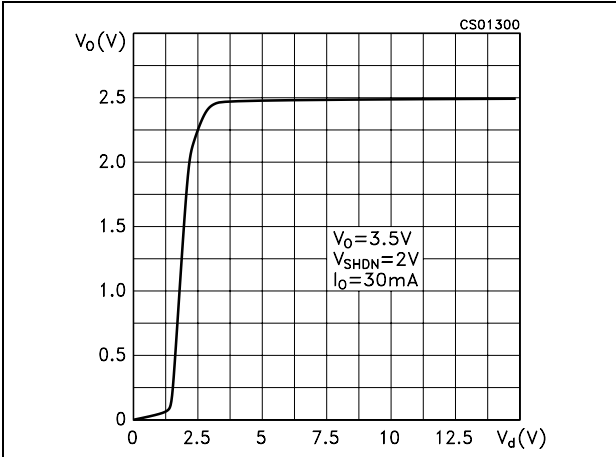


Figure 10. Shutdown voltage vs. temperature

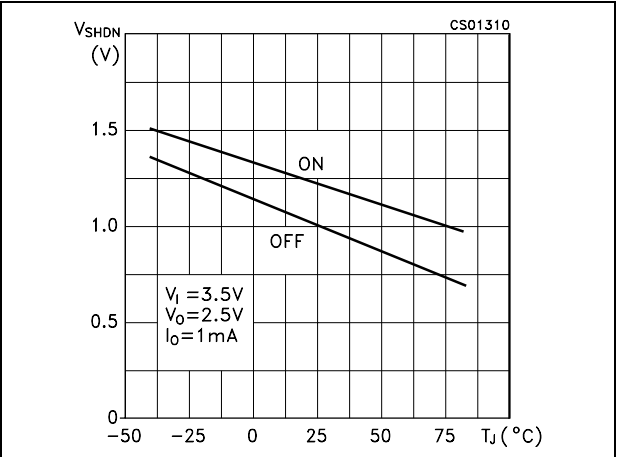


Figure 11. Shutdown current vs. shutdown voltage

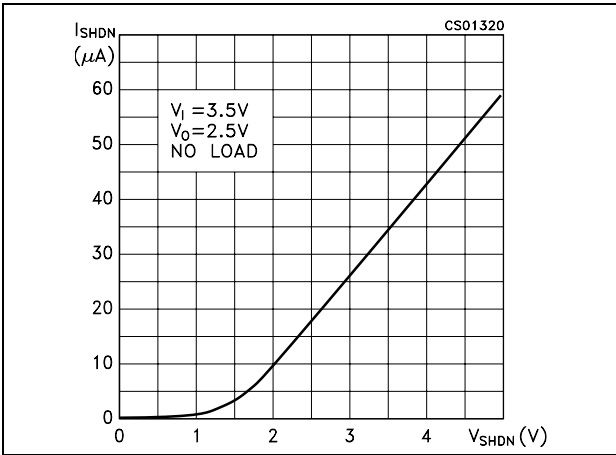


Figure 12. Supply voltage rejection vs. temperature

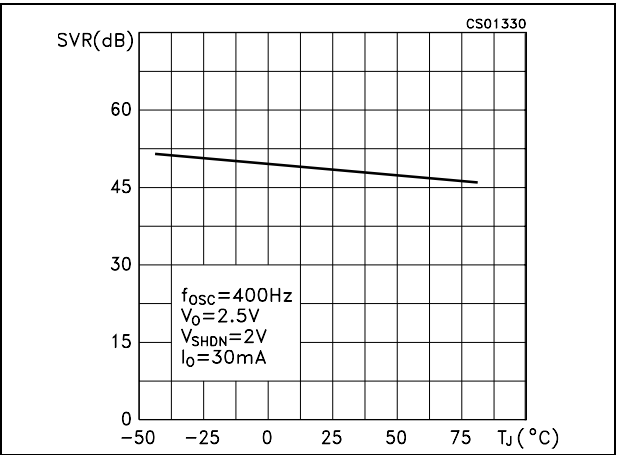


Figure 13. Supply voltage rejection vs. output current

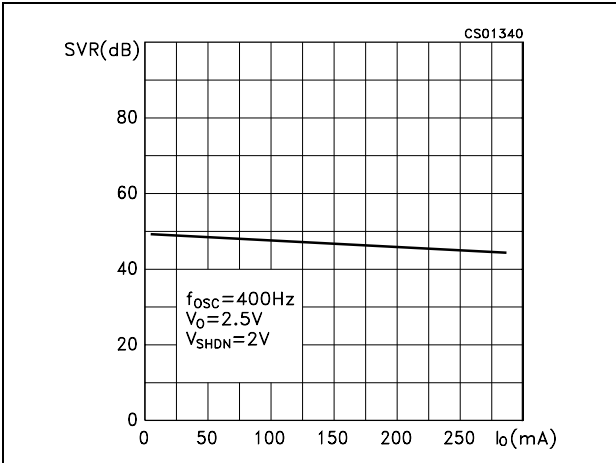


Figure 14. Supply voltage rejection vs. frequency

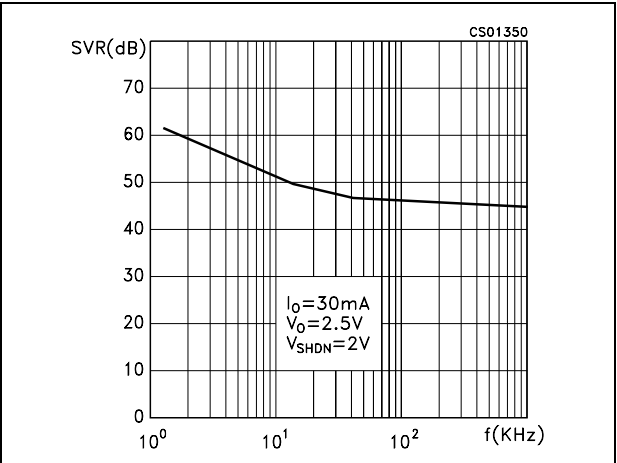




Figure 15. Supply voltage rejection vs. temperature

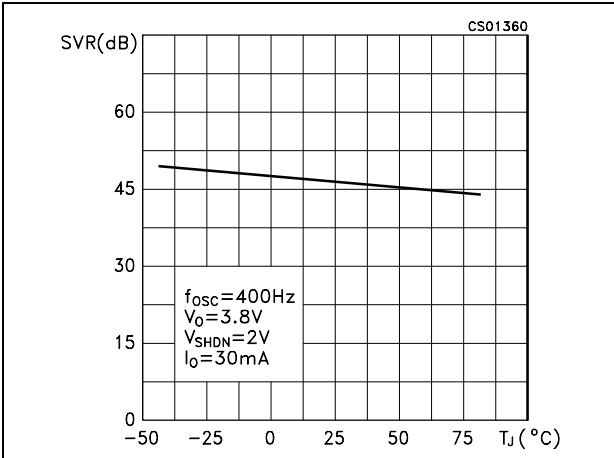


Figure 16. Quiescent current vs. temperature

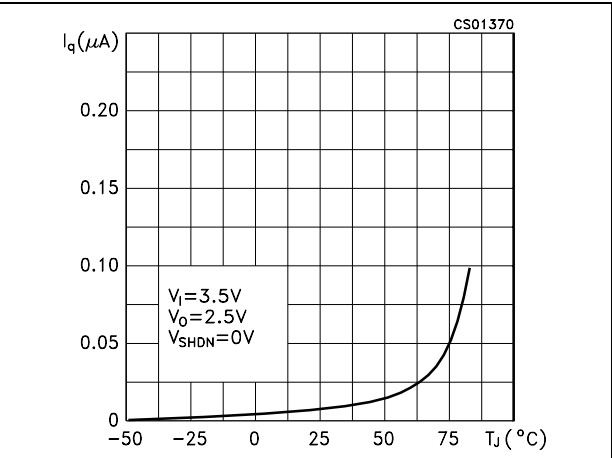


Figure 17. Quiescent current vs. input voltage

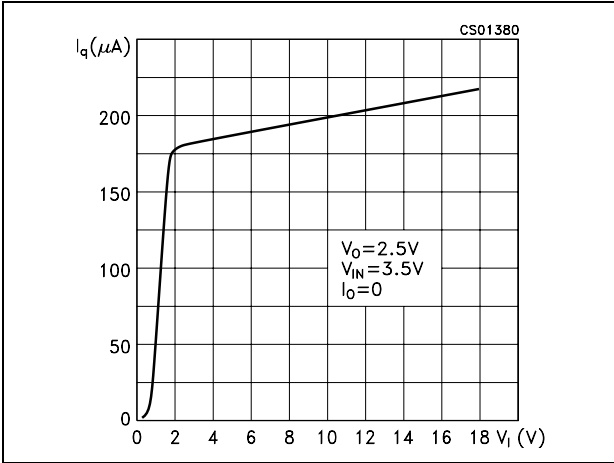


Figure 18. Quiescent current vs. shutdown voltage

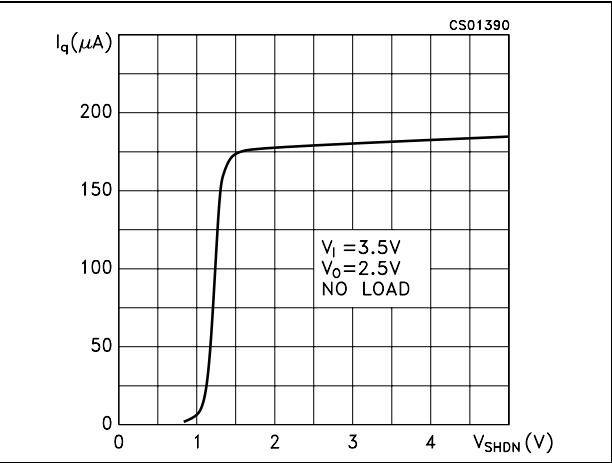


Figure 19. Quiescent current vs. output current

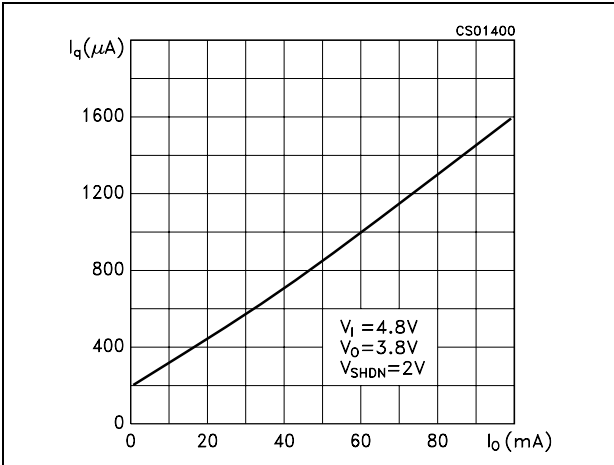


Figure 20. Reverse current vs. reverse voltage

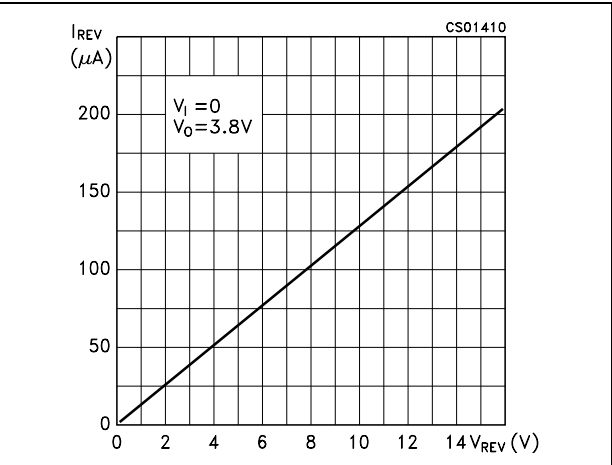


Figure 21. Stability

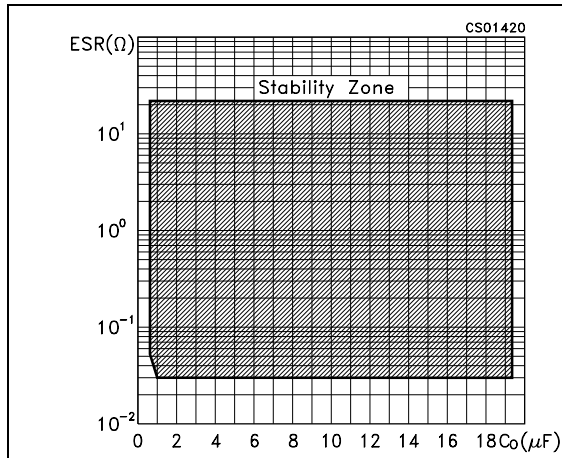


Figure 22. Spectrum noise

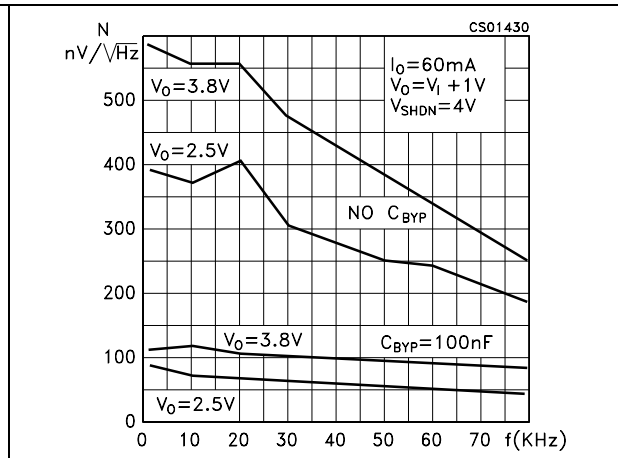


Figure 23. Start-up transient

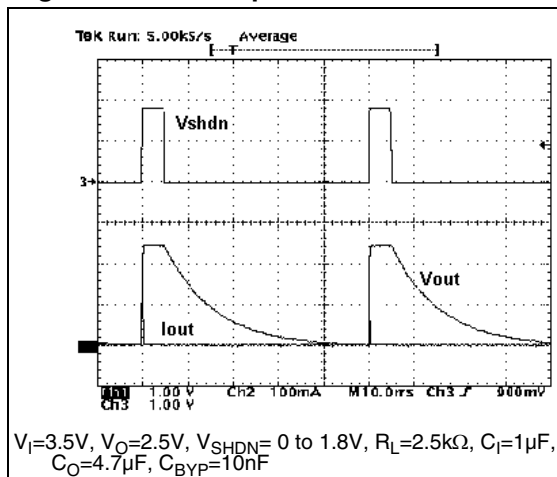


Figure 24. Start-up transient

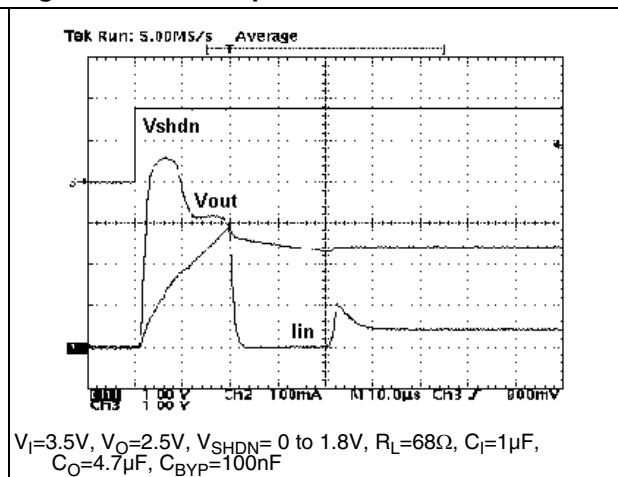


Figure 25. Line transient

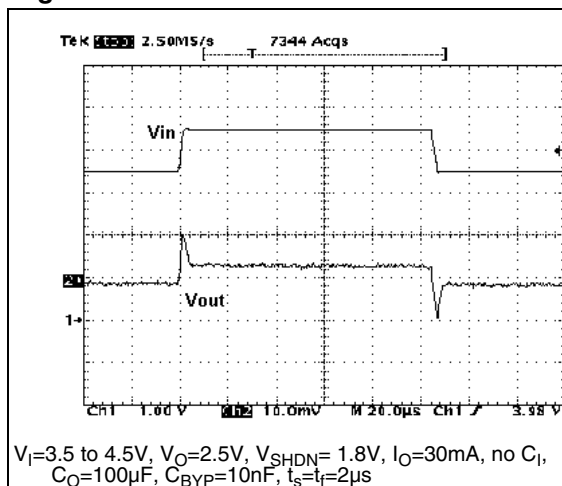


Figure 26. Line transient

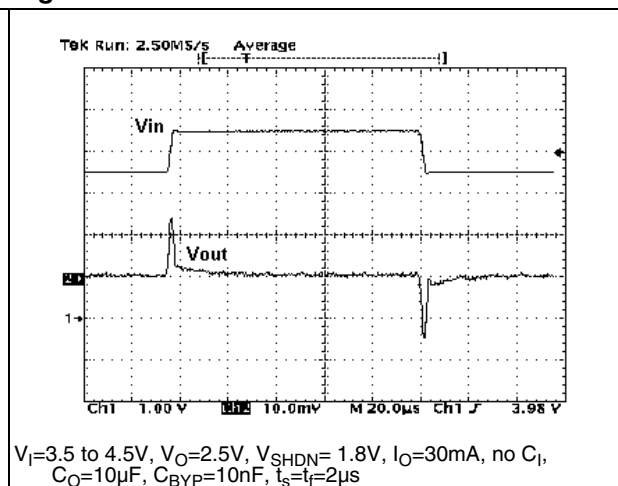


Figure 27. Line transient

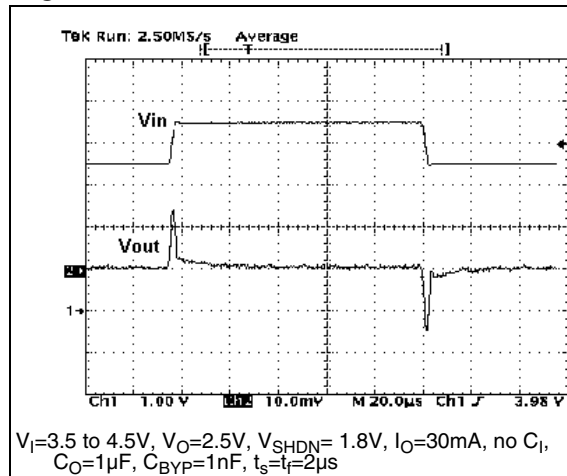


Figure 28. Load transient

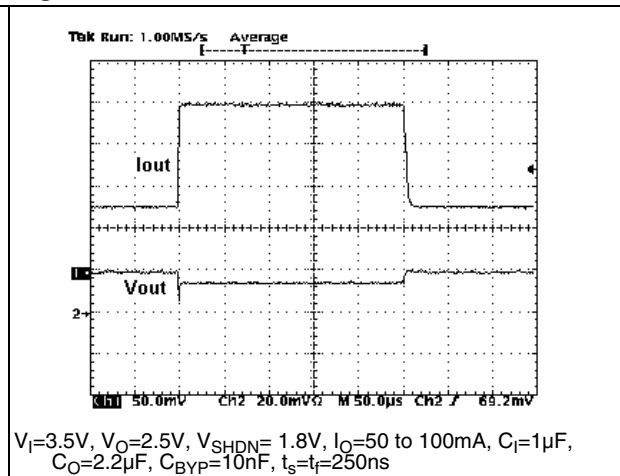


Figure 29. Load transient

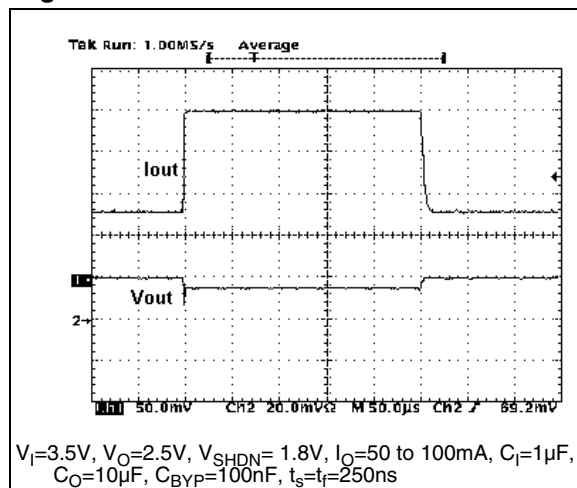
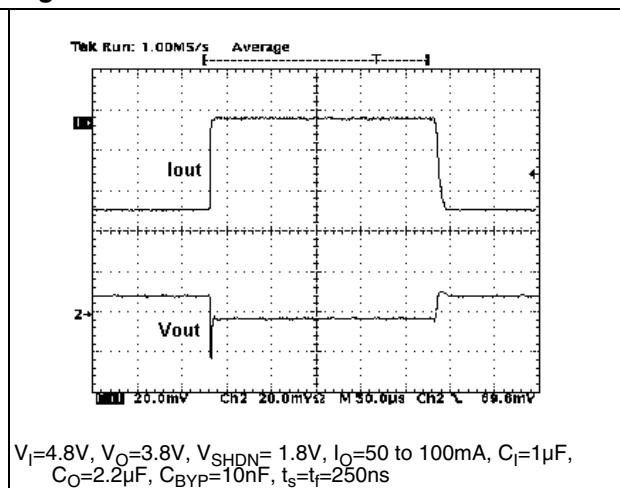


Figure 30. Load transient

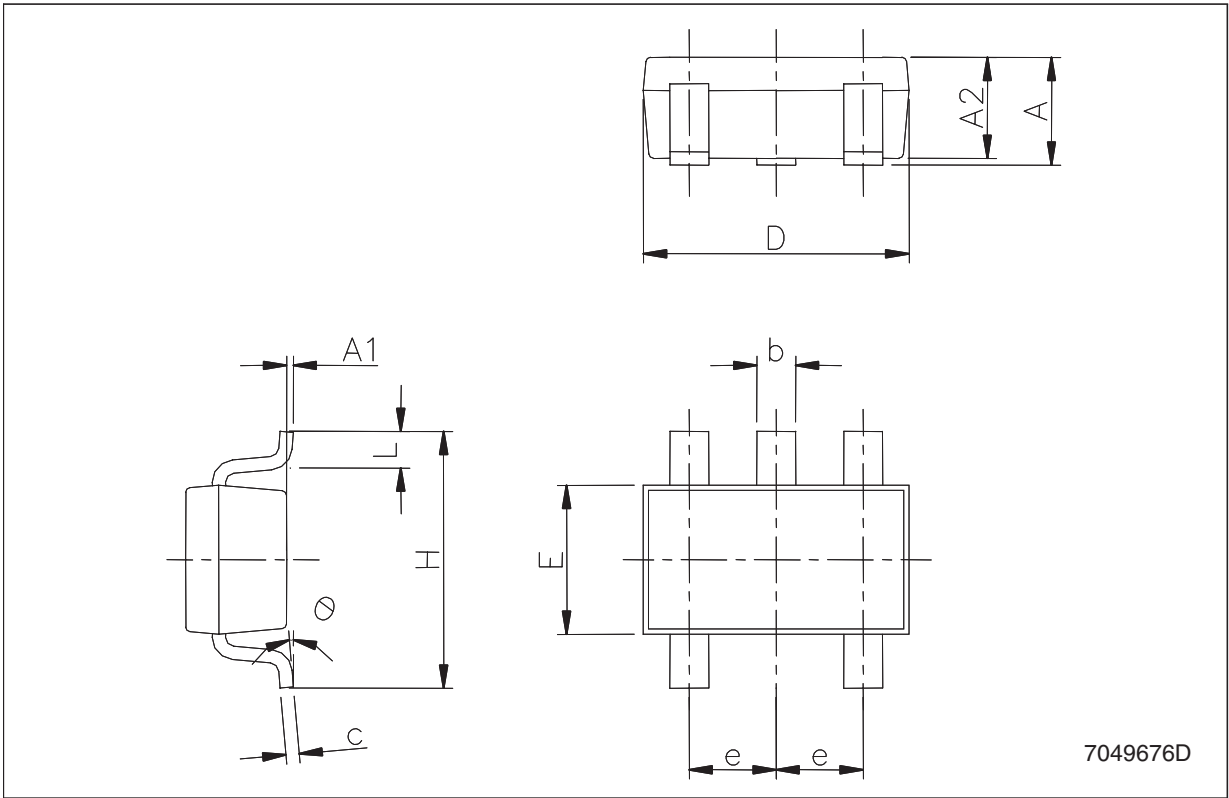


## 6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in 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.

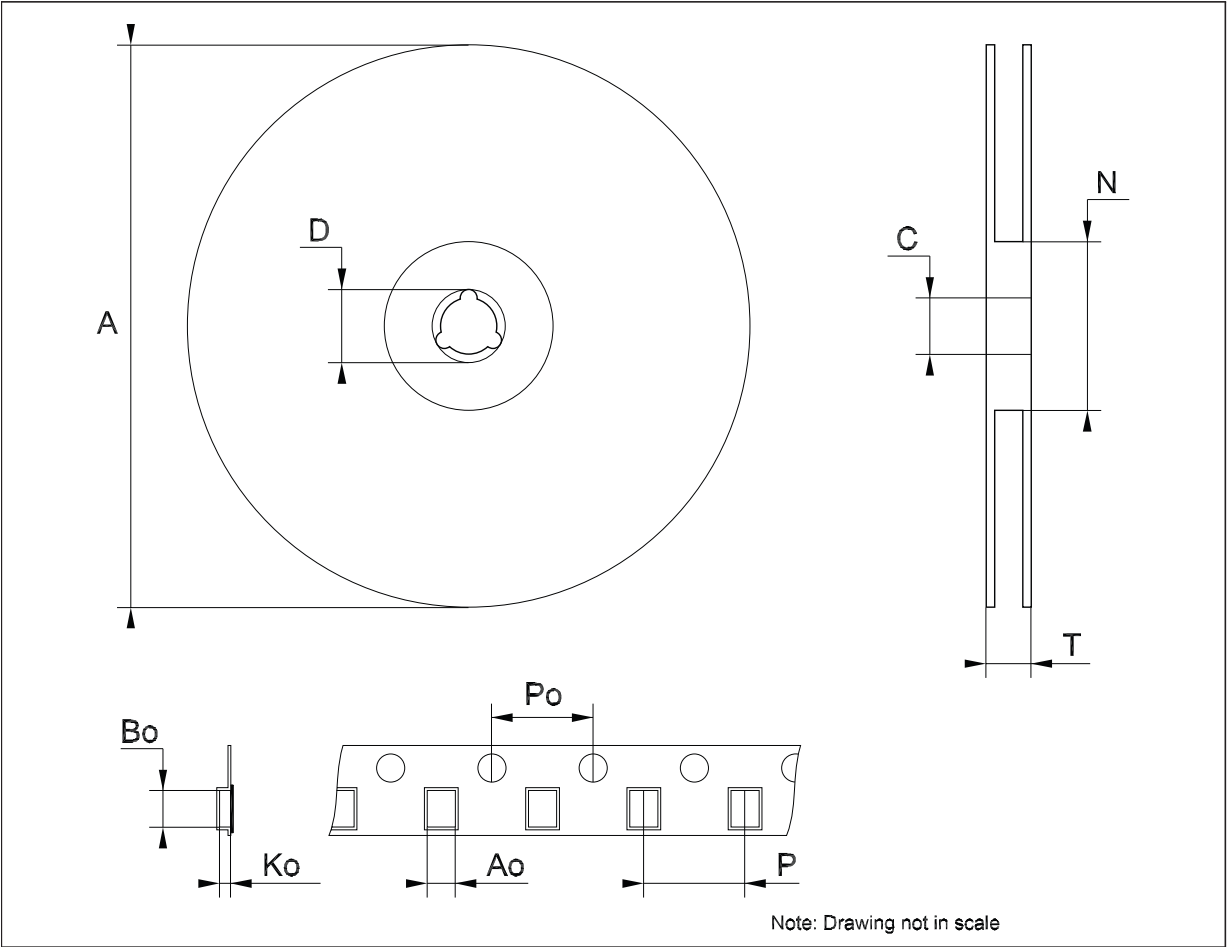
SOT23-5L mechanical data

| 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**

| Order codes               | Output voltages | V <sub>OUT</sub> Min. | V <sub>OUT</sub> Max | Test voltage |
|---------------------------|-----------------|-----------------------|----------------------|--------------|
| LK112M14TR <sup>(1)</sup> | 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 <sup>(1)</sup> | 1.9V            | 1.84V                 | 1.96V                | 2.4V         |
| LK112M20TR <sup>(1)</sup> | 2.0V            | 1.94V                 | 2.06V                | 3.0V         |
| LK112M22TR <sup>(1)</sup> | 2.2V            | 2.14V                 | 2.26V                | 3.2V         |
| LK112M23TR <sup>(1)</sup> | 2.3V            | 2.24V                 | 2.36V                | 3.3V         |
| LK112M24TR <sup>(1)</sup> | 2.4V            | 2.34V                 | 2.46V                | 3.4V         |
| LK112M25TR                | 2.5V            | 2.44V                 | 2.56V                | 3.5V         |
| LK112M26TR <sup>(1)</sup> | 2.6V            | 2.54V                 | 2.66V                | 3.6V         |
| LK112M29TR <sup>(1)</sup> | 2.9V            | 2.84V                 | 2.96V                | 3.9V         |
| LK112M31TR <sup>(1)</sup> | 3.1V            | 3.04V                 | 3.16V                | 4.1V         |
| LK112M33TR                | 3.3V            | 3.24V                 | 3.36V                | 4.3V         |
| LK112M34TR <sup>(1)</sup> | 3.4V            | 3.335V                | 3.465V               | 4.4V         |
| LK112M35TR <sup>(1)</sup> | 3.5V            | 3.435V                | 3.565V               | 4.5V         |
| LK112M37TR <sup>(1)</sup> | 3.7V            | 3.630V                | 3.770V               | 4.7V         |
| LK112M39TR <sup>(1)</sup> | 3.9V            | 3.825V                | 3.975V               | 4.9V         |
| LK112M41TR <sup>(1)</sup> | 4.1V            | 4.020V                | 4.180V               | 5.1V         |
| LK112M42TR <sup>(1)</sup> | 4.2V            | 4.120V                | 4.280V               | 5.2V         |
| LK112M43TR <sup>(1)</sup> | 4.3V            | 4.215V                | 4.385V               | 5.3V         |
| LK112M44TR <sup>(1)</sup> | 4.4V            | 4.315V                | 4.485V               | 5.4V         |
| LK112M45TR <sup>(1)</sup> | 4.5V            | 4.410V                | 4.590V               | 5.5V         |
| LK112M46TR <sup>(1)</sup> | 4.6V            | 4.510V                | 4.690V               | 5.6V         |
| LK112M48TR <sup>(1)</sup> | 4.8V            | 4.705V                | 4.895V               | 5.8V         |
| LK112M49TR <sup>(1)</sup> | 4.9V            | 4.800V                | 5.000V               | 5.9V         |
| LK112M50TR                | 5.0V            | 4.900V                | 5.100V               | 6.0V         |
| LK112M55TR                | 5.5V            | 5.390V                | 5.610V               | 6.5V         |
| 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 <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 6</a> .                                                  |
| 12-Feb-2008 | 14       | Modified: <a href="#">Table 6 on page 15</a> .                                       |
| 10-Jul-2008 | 15       | Modified: <a href="#">Table 1 on page 1</a> and <a href="#">Table 6 on page 15</a> . |
| 28-Feb-2011 | 16       | Modified: <a href="#">Table 6 on page 15</a> .                                       |



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