# LK112S

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

**Datasheet - production data**

**SOT23-5L**

## 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 ± 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 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.

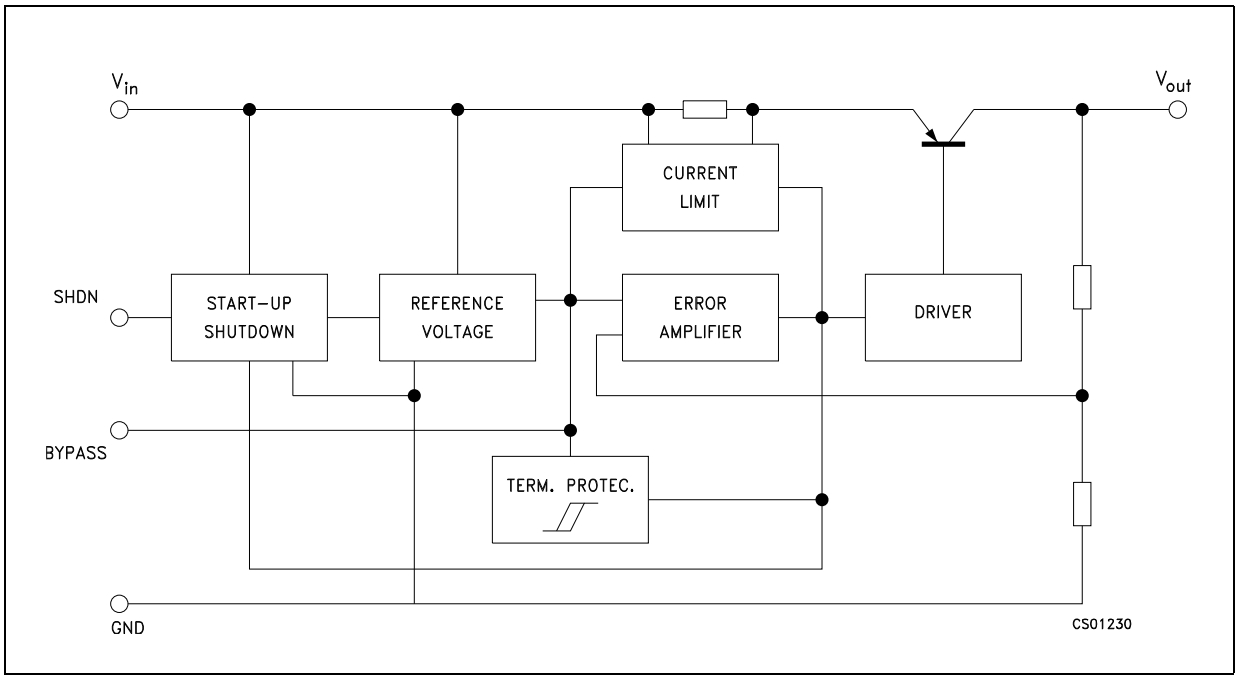
**Table 1. Device summary**

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

# Contents

# 1 Diagram

**Figure 1. Schematic diagram**



# 2 Pin configuration

**Figure 2. Pin connection (top view)**

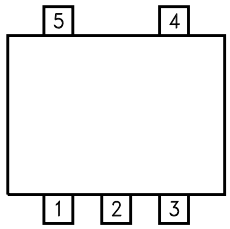



**Table 2. Pin description**

| 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 µF 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 °C, $V_{IN}$ = $V_{OUT}$ +1 V, $I_{OUT}$ = 0 mA, $V_{SHDN}$ = 1.8 V, $C_I$ = 1 µF, $C_O$ = 2.2 µF, $C_{BYPASS}$ = 0.1 µF 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 V, $V_{SHDN}$ = 0 V | | 0 | 0.1 | µA |
| $V_O$ | Output voltage | $I_O$ = 30 mA | -2 | | +2 | % |
| $\Delta V_O$ | Line regulation | $V_I$ = $V_O$+1 V to $V_O$+6 V, $V_O \leq$ 5.6 V | | 0.7 | 20 | mV |
| | | $V_I$ = $V_O$+1 V to $V_O$+6 V, $V_O >$ 5.6 V | | 0.8 | 40 | mV |
| $\Delta V_O$ | 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 mA | | 0.17 | 0.24 | V |
| | | $I_O$ = 200 mA(1) | | 0.35 | 0.5 | V |
| $I_{SC}$ | Short-circuit current | | 200 | | | mA |
| SVR | Supply voltage rejection | $V_I$ = $V_O$+1.5 V, $C_{BYP}$ = 0.1 µF<br>$C_O$ = 10 µF, f = 400 Hz, $I_O$ = 30 mA | | 55 | | dB |
| eN | Output noise voltage | B= 10 Hz to 80 kHz, $C_{BYP}$ = 0.1 µF<br>$C_O$ = 10 µF, $V_I$ = $V_O$+1.5 V, $I_O$ = 60 mA | | 30 | | µVrms |
| $I_{SHDN}$ | Shutdown input current | $V_{SHDN}$ = 1.8 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 mA | | 0.09 | | mV/°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 VIN = 2.4 V*

# 5 Typical characteristics

(Unless otherwise specified, $T_J$ = 25 °C, $C_I$ = 1 µF, $C_O$ = 2.2 µF, $C_{BYP}$ = 100 nF)

**Figure 3. Output voltage vs temperature $V_{out}$=2.5 V**

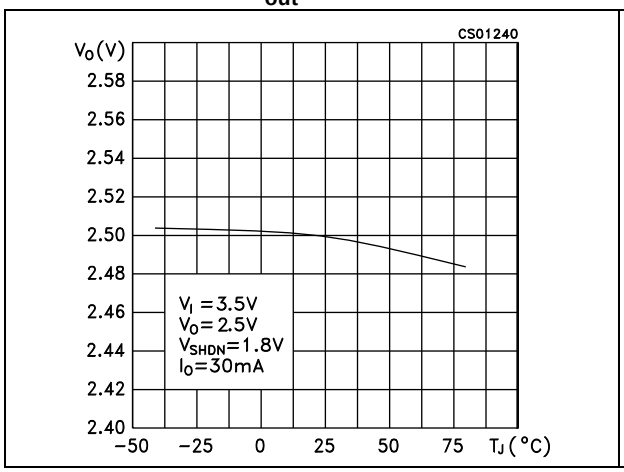



**Figure 4. Output voltage vs temperature $V_{out}$=3.8 V**

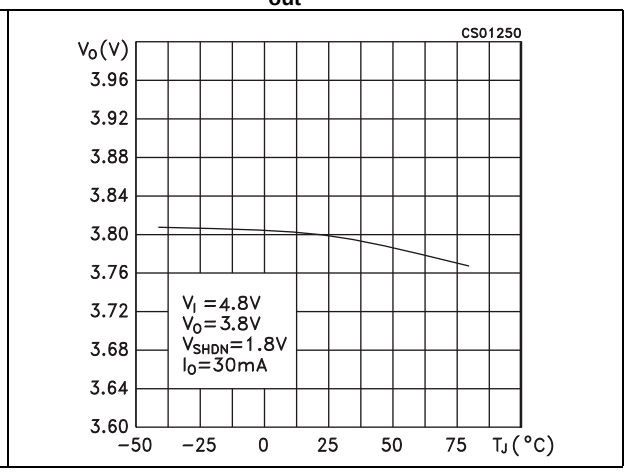



**Figure 5. Line regulation vs temperature**

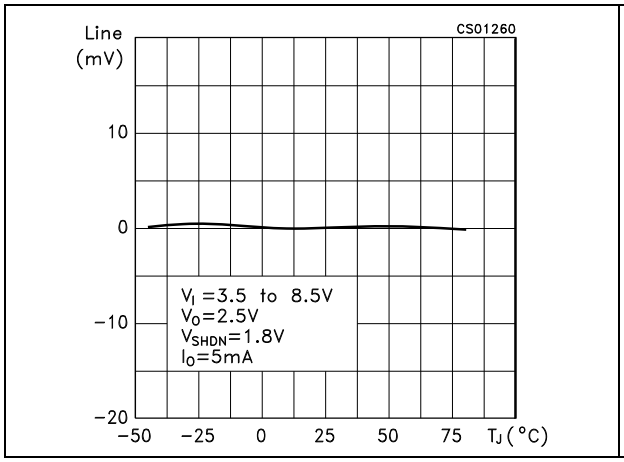



**Figure 6. Load regulation vs temperature**

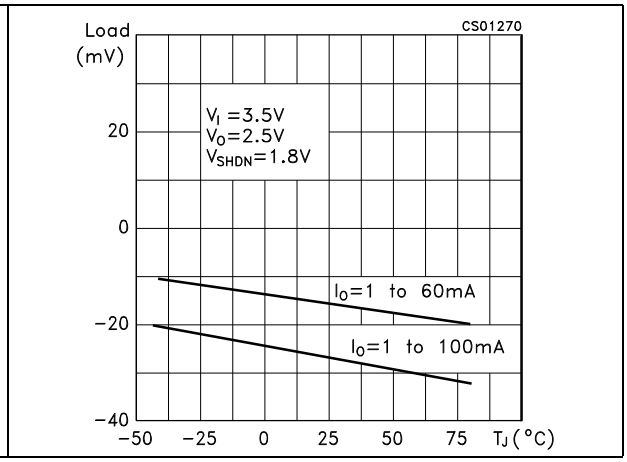


**Figure 7. Dropout voltage vs temperature**

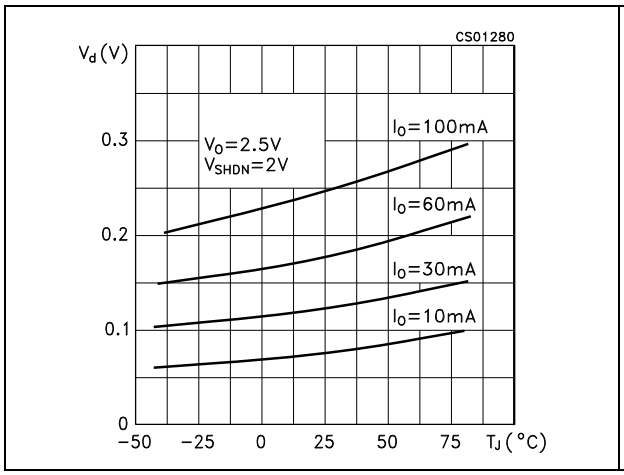



**Figure 8. Short-circuit current vs dropout voltage**

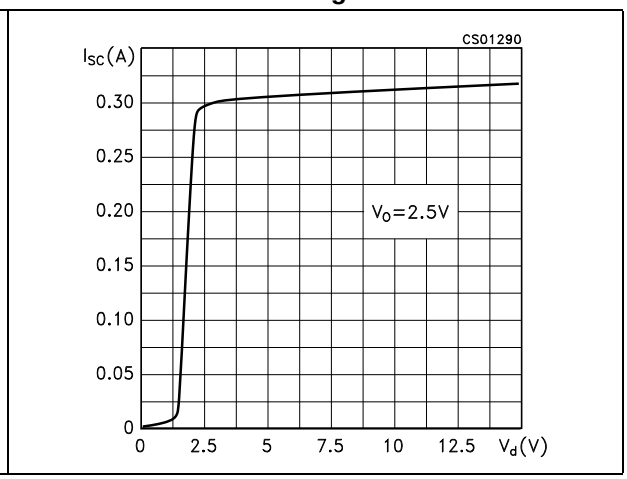



**Figure 9. Output voltage vs input voltage**

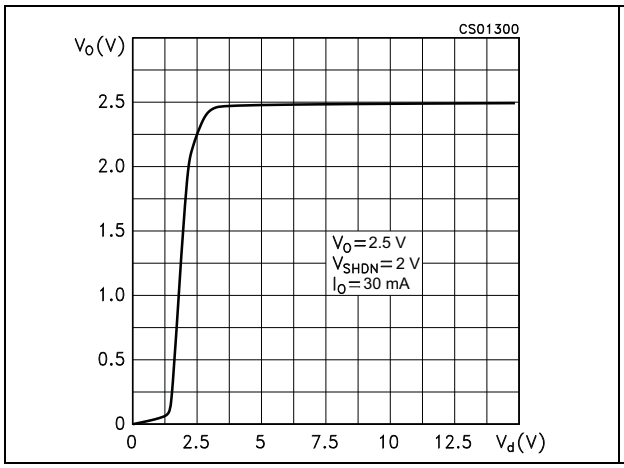



**Figure 10. Shutdown voltage vs temperature**

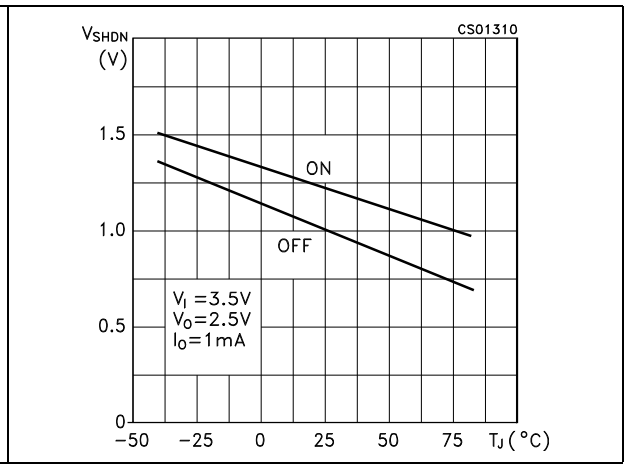



**Figure 11. Shutdown current vs shutdown voltage**

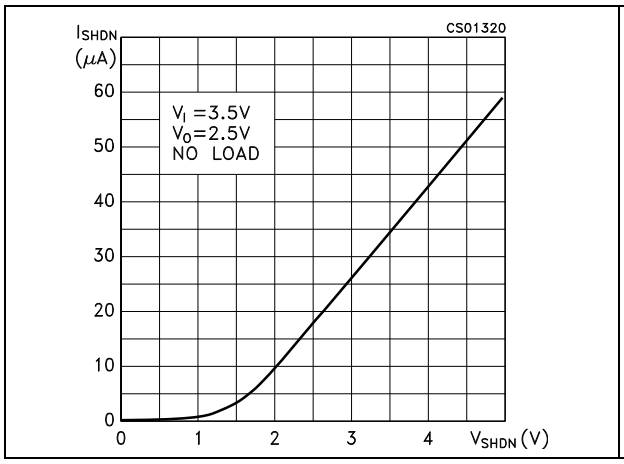



**Figure 12. Supply voltage rejection vs temperature**

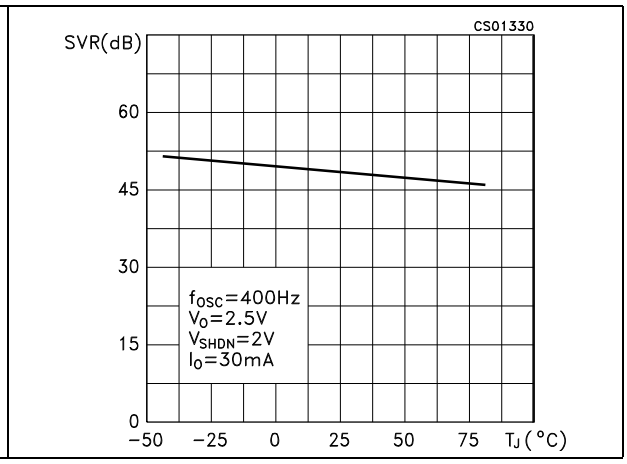


**Figure 13. Supply voltage rejection vs output current**

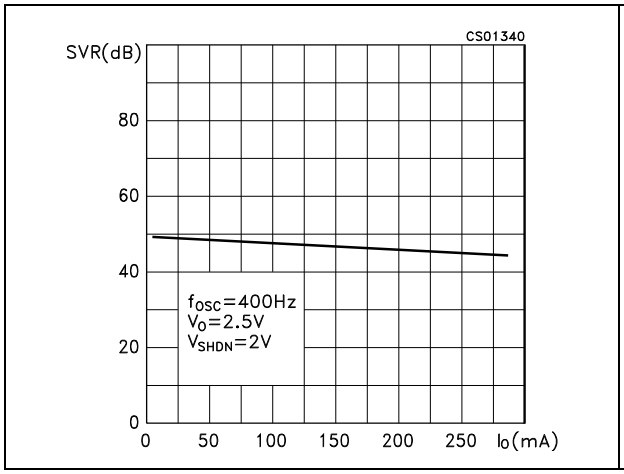



**Figure 14. Supply voltage rejection vs frequency**

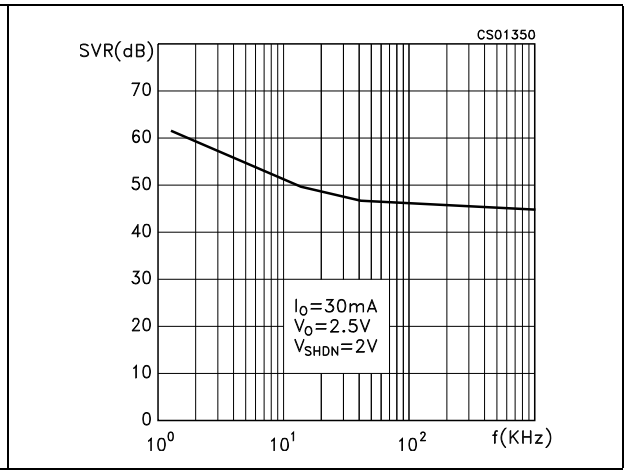



**Figure 15. Supply voltage rejection vs temperature**

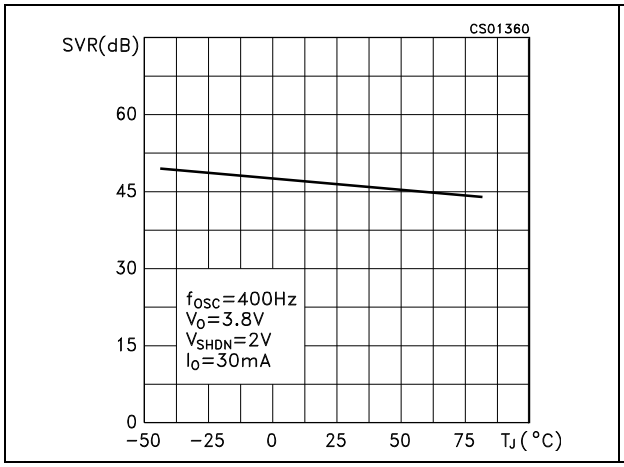



**Figure 16. Shutdown current vs temperature**

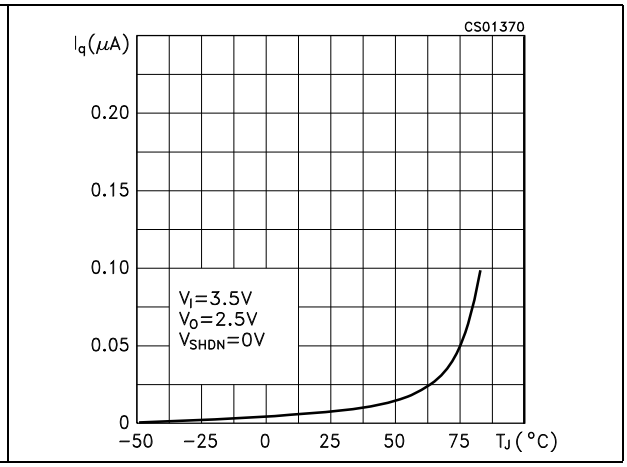



**Figure 17. Quiescent current vs input voltage**

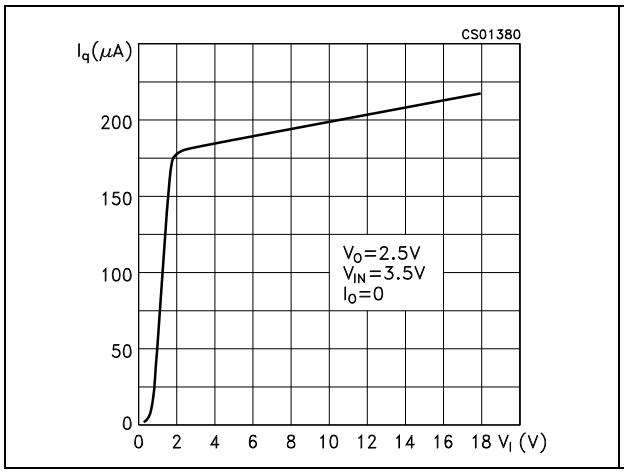



**Figure 18. Quiescent current vs shutdown voltage**

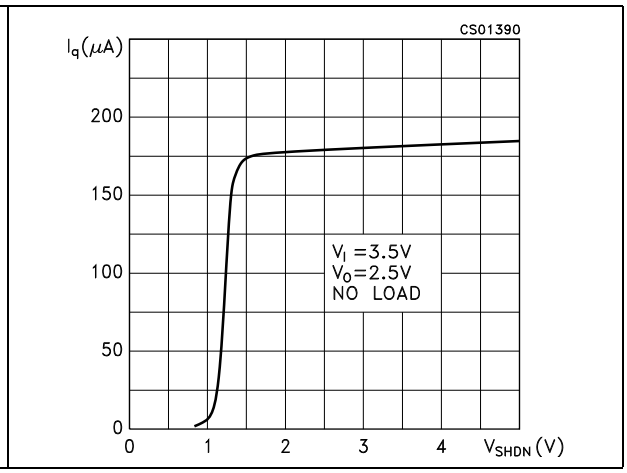


**Figure 19. Quiescent current vs temperature**

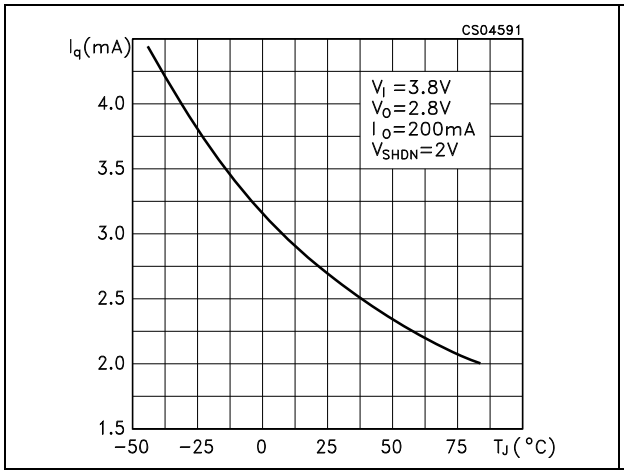



**Figure 20. Reverse current vs reverse voltage**

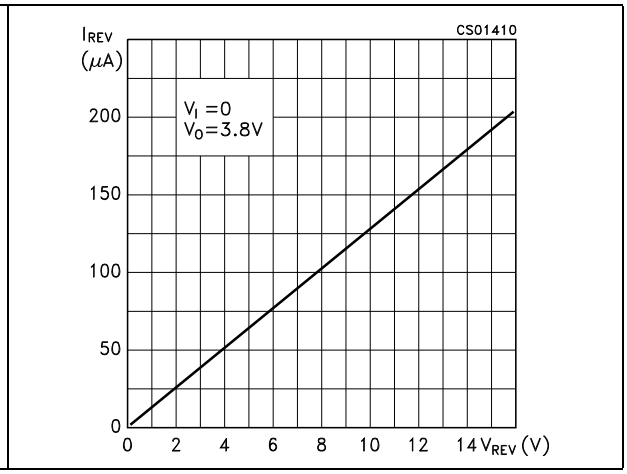



**Figure 21. Stability**

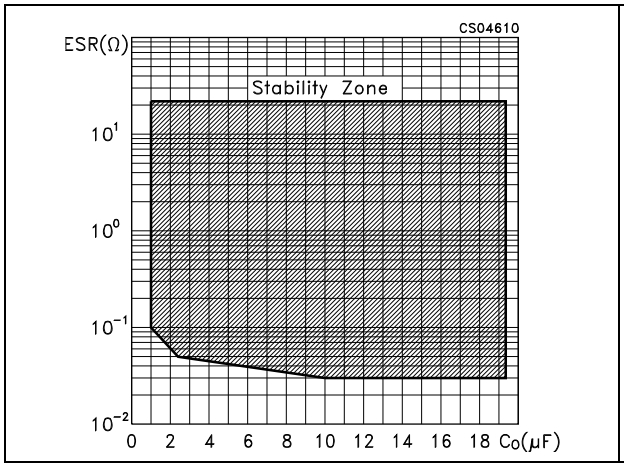



**Figure 22. Noise spectrum**

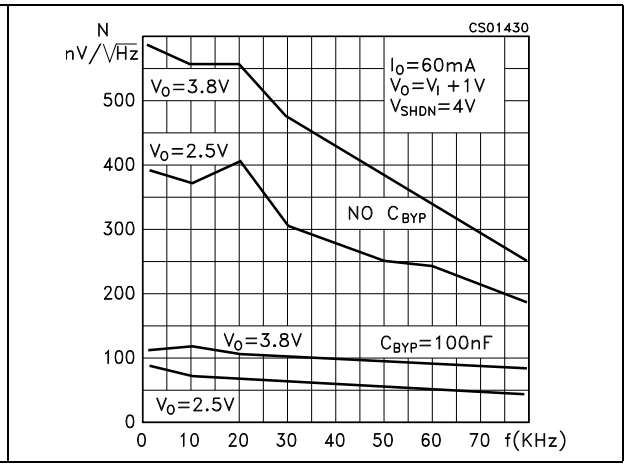
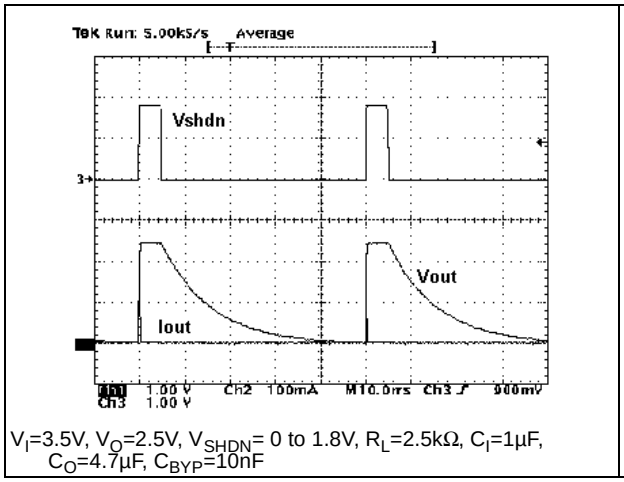
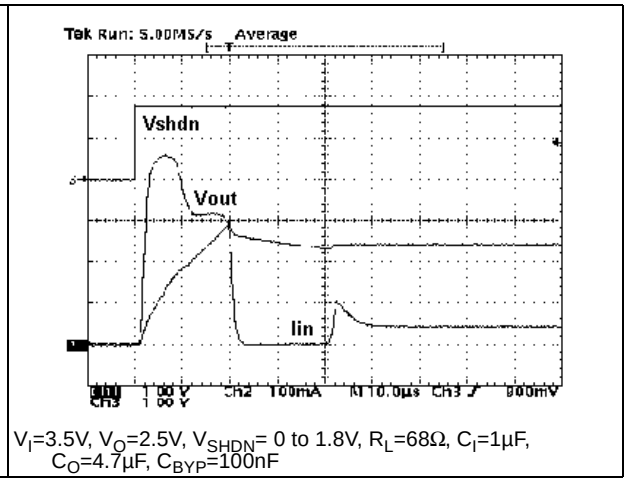



**Figure 23. Start-up transient $C_{BYP}$=10 nF**



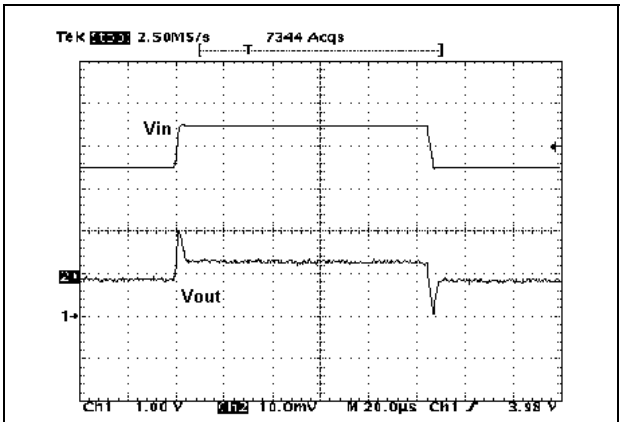

$V_I$=3.5V, $V_O$=2.5V, $V_{SHDN}$= 0 to 1.8V, $R_L$=2.5kΩ, $C_I$=1µF, $C_O$=4.7µF, $C_{BYP}$=10nF

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



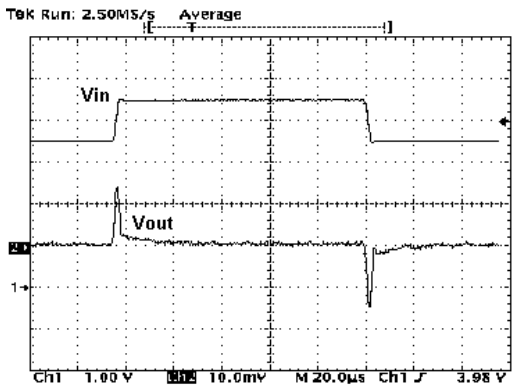

$V_I$=3.5V, $V_O$=2.5V, $V_{SHDN}$= 0 to 1.8V, $R_L$=68Ω, $C_I$=1µF, $C_O$=4.7µF, $C_{BYP}$=100nF

**Figure 25. Line transient Co=100 µF**



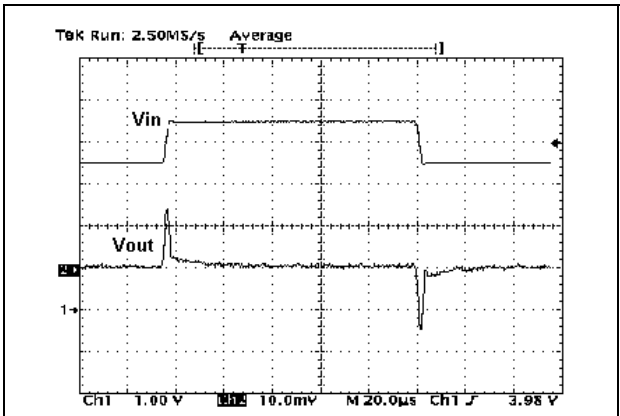

$V_I$=3.5 to 4.5V, $V_O$=2.5V, $V_{SHDN}$= 1.8V, $I_O$=30mA, no $C_I$, $C_O$=100µF, $C_{BYP}$=10nF, $t_s$=$t_f$=2µs

**Figure 26. Line transient Co=10 µF**



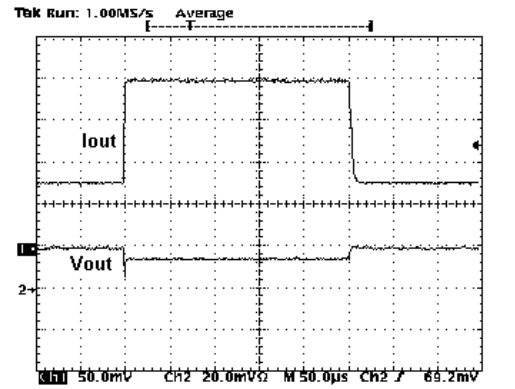

$V_I$=3.5 to 4.5V, $V_O$=2.5V, $V_{SHDN}$= 1.8V, $I_O$=30mA, no $C_I$, $C_O$=10µF, $C_{BYP}$=10nF, $t_s$=$t_f$=2µs

**Figure 27. Line transient Co=1 µF**



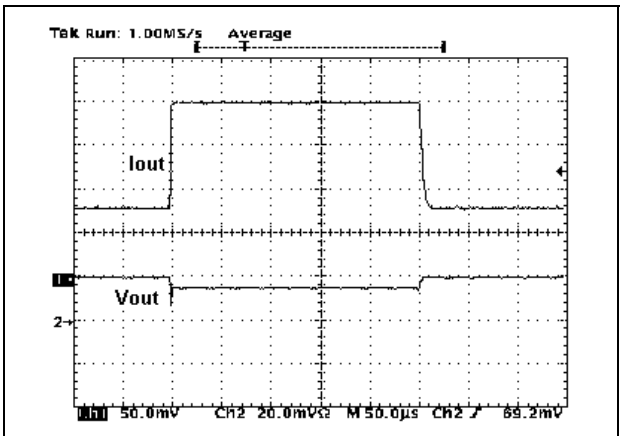

$V_I$=3.5 to 4.5V, $V_O$=2.5V, $V_{SHDN}$= 1.8V, $I_O$=30mA, no $C_I$, $C_O$=1µF, $C_{BYP}$=1nF, $t_s$=$t_f$=2µs

**Figure 28. Load transient Vo=2.5 V, Co=2.2 µF**



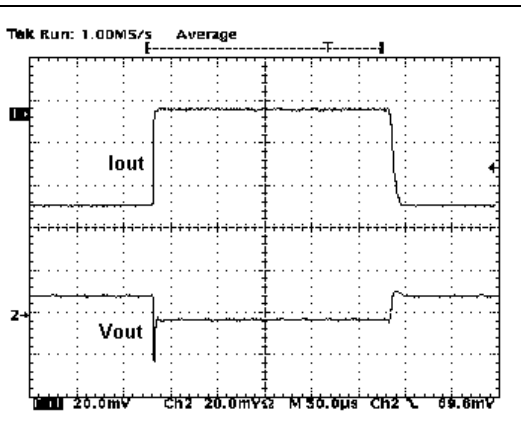

$V_I$=3.5V, $V_O$=2.5V, $V_{SHDN}$= 1.8V, $I_O$=50 to 100mA, $C_I$=1µF, $C_O$=2.2µF, $C_{BYP}$=10nF, $t_s$=$t_f$=250ns

**Figure 29. Load transient Vo=2.5 V, Co=10 µF**




$V_I$=3.5V, $V_O$=2.5V, $V_{SHDN}$= 1.8V, $I_O$=50 to 100mA, $C_I$=1µF, $C_O$=10µF, $C_{BYP}$=100nF, $t_s$=$t_f$=250ns

**Figure 30. Load transient Vo=3.8 V,Co=2.2 µF**




$V_I$=4.8V, $V_O$=3.8V, $V_{SHDN}$= 1.8V, $I_O$=50 to 100mA, $C_I$=1µF, $C_O$=2.2µF, $C_{BYP}$=10nF, $t_s$=$t_f$=250ns

# 6 Package mechanical data

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

**Figure 31. SOT23-5L mechanical drawings**

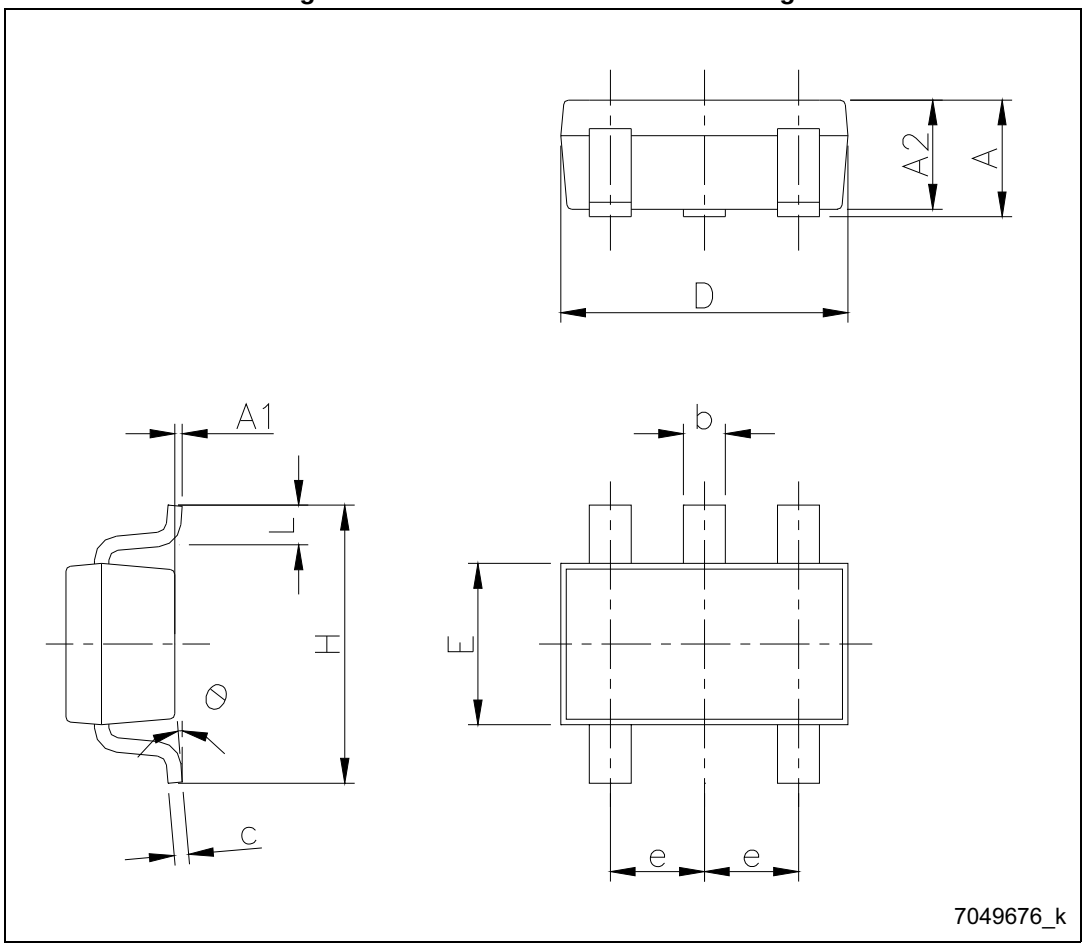
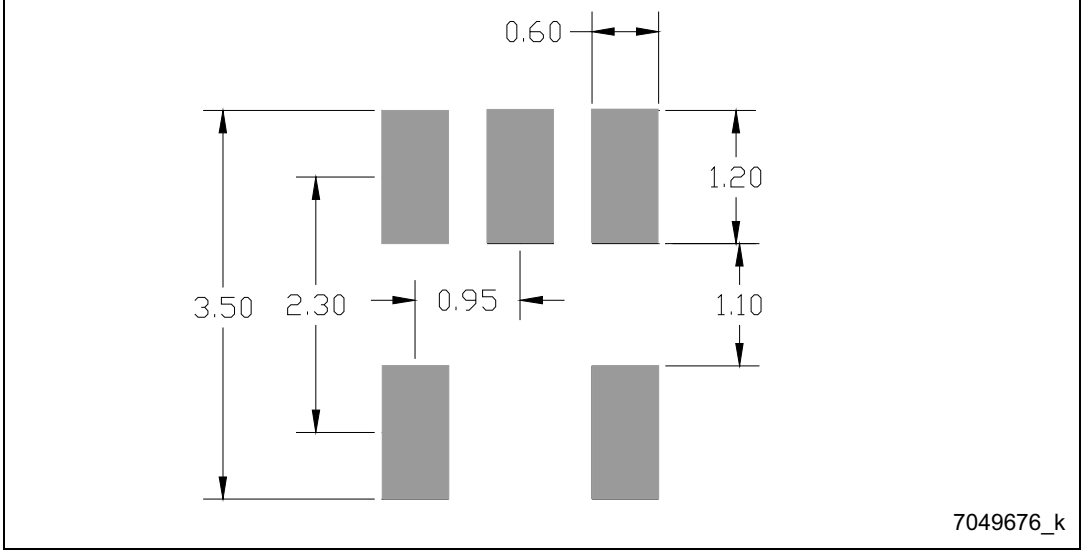


**Table 6. SOT23-5L mechanical data**

| 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 |
| θ | 0 | | 8 |

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



# 7 Packaging mechanical data

**Figure 33.SOT23-5L tape and reel drawings**

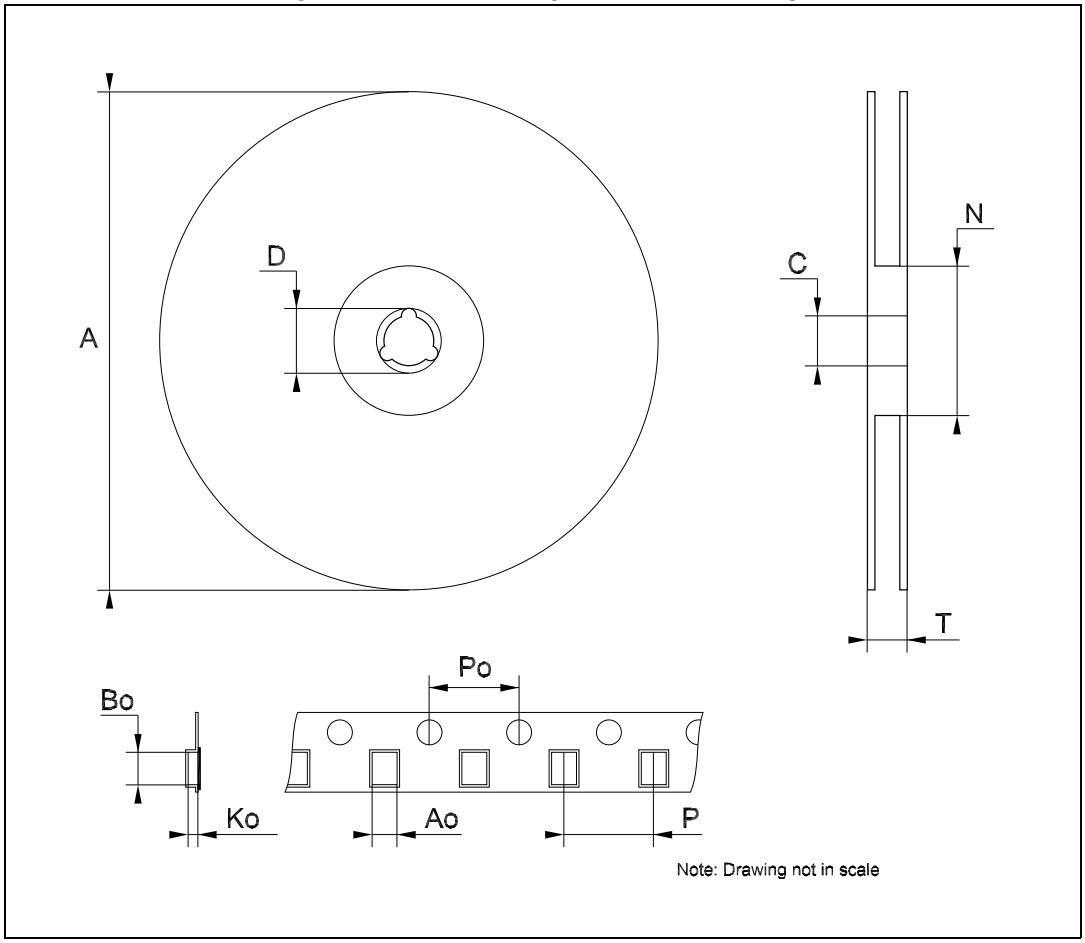


**Figure 34.SOT23-5L tape and reel mechanical data**

| 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.<br>Updated the title and the *Description* in cover page, *Table 2: Pin description*, *Section 5: Typical characteristics* and *Section 6: Package mechanical data*.<br>Added *Section 7: Packaging mechanical data*.<br>Minor text changes. |

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- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

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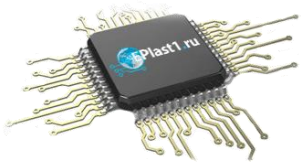
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.




**Как с нами связаться**

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