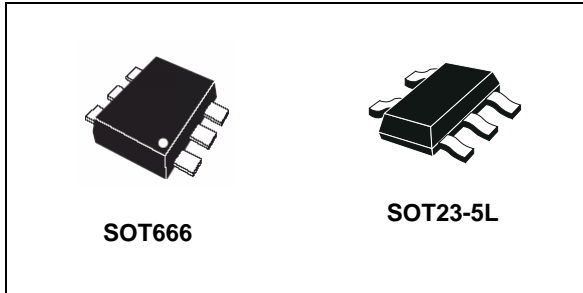


150 mA low quiescent current and low noise voltage regulator

Datasheet - production data



- Logic-controlled electronic shutdown
- Compatible with ceramic capacitors $C_O = 1 \mu\text{F}$
- Internal current and thermal limit
- Available in SOT666 and SOT23-5L packages
- Temperature range: $-40 \text{ }^\circ\text{C}$ to $125 \text{ }^\circ\text{C}$

Description

The LD39015 series provides 150 mA maximum current with an input voltage range from 1.5 V to 5.5 V and a typical dropout voltage of 80 mV. It is stable with ceramic capacitors. The ultra low drop voltage, low quiescent current and low noise features make it suitable for low power battery-powered applications. Power supply rejection is 65 dB at low frequencies and starts rolling off at 10 kHz. Enable logic control function puts the LD39015 in shutdown mode allowing a total current consumption lower than $1 \mu\text{A}$. The device also includes short-circuit constant current limiting and thermal protection. Typical applications are mobile phones, personal digital assistants (PDAs), cordless phones or similar battery-powered systems.

Features

- Input voltage from 1.5 to 5.5 V
- Ultra low-dropout voltage (80 mV typ. at 100 mA load)
- Very low quiescent current (18 μA typ. at no load, 38 μA typ. at 150 mA load, 1 μA max. in OFF mode)
- Very low noise without bypass capacitor (29 μV_{RMS} at $V_{\text{OUT}} = 0.8 \text{ V}$)
- Output voltage tolerance: $\pm 2.0\%$ @ $25 \text{ }^\circ\text{C}$
- 150 mA guaranteed output current
- Wide range of output voltages available on request: 0.8 V to 3.3 V with 100 mV step

Table 1. Device summary

| Order codes | | Output voltages |
|-----------------------------|--------------|-----------------|
| SOT666 | SOT23-5L | |
| LD39015XG08R | LD39015M08R | 0.8 V |
| LD39015XG10R | LD39015M10R | 1.0 V |
| LD39015XG12R ⁽¹⁾ | LD39015M12R | 1.2 V |
| | LD39015M125R | 1.25 V |
| LD39015XG15R | LD39015M15R | 1.5 V |
| LD39015XG18R ⁽¹⁾ | LD39015M18R | 1.8 V |
| LD39015XG25R ⁽¹⁾ | LD39015M25R | 2.5 V |
| LD39015XG33R ⁽¹⁾ | LD39015M33R | 3.3 V |

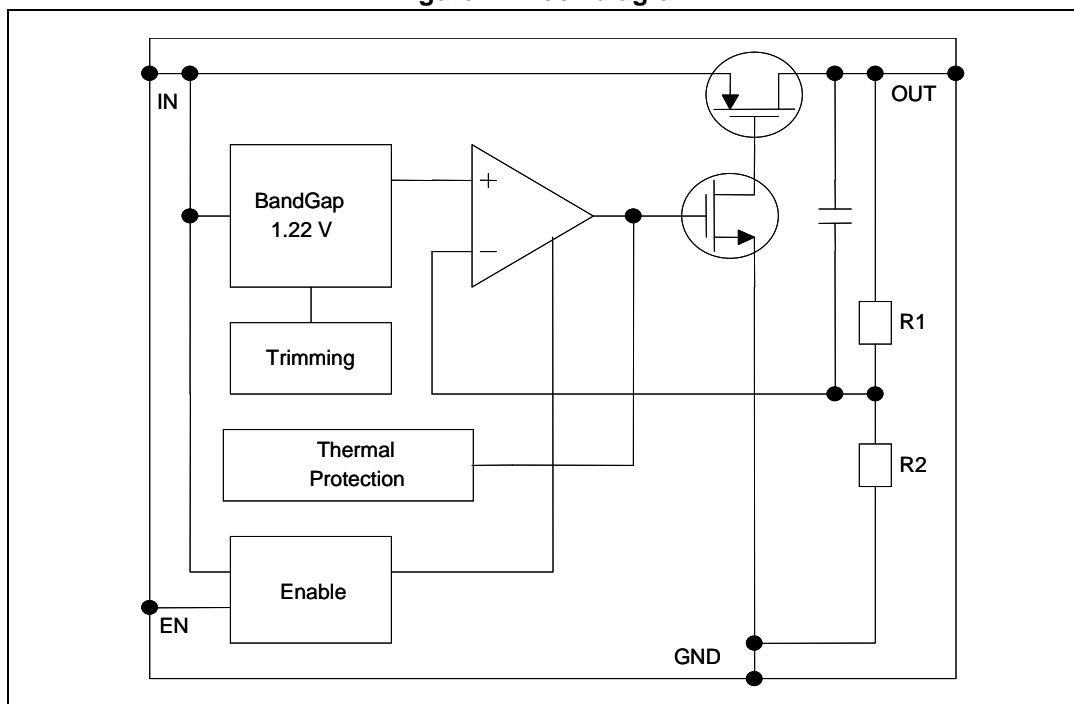
1. Available on request. Other voltages available on request from 0.8 V to 3.3 V in 100 mV step.

Contents

| | | |
|---|---|----|
| 1 | Diagram | 3 |
| 2 | Pin configuration | 4 |
| 3 | Typical application | 5 |
| 4 | Maximum ratings | 6 |
| 5 | Electrical characteristics | 7 |
| 6 | Typical performance characteristics | 9 |
| 7 | Package mechanical data | 11 |
| 8 | Packaging mechanical data | 14 |
| 9 | Revision history | 15 |

1 Diagram

Figure 1. Block diagram



2 Pin configuration

Figure 2. Pin connection (top view)

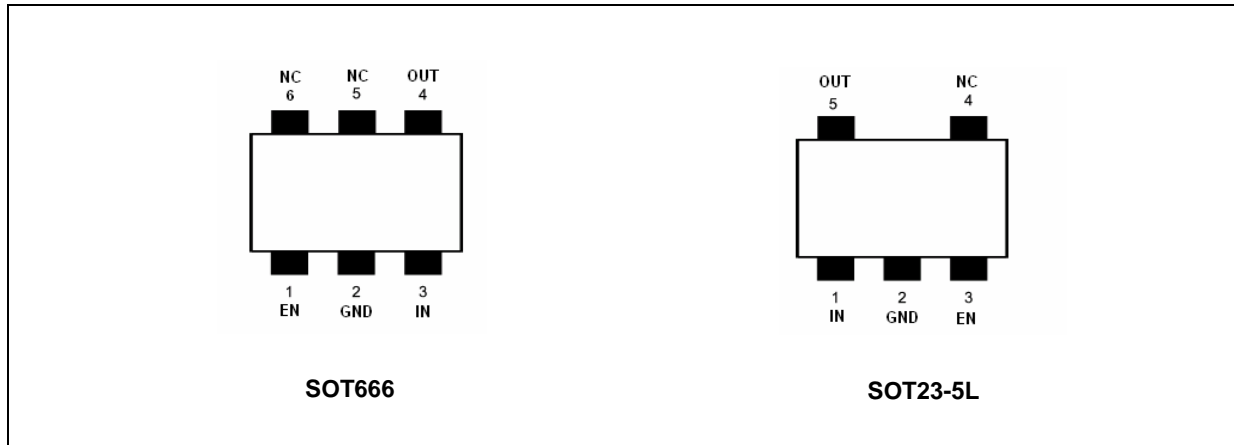
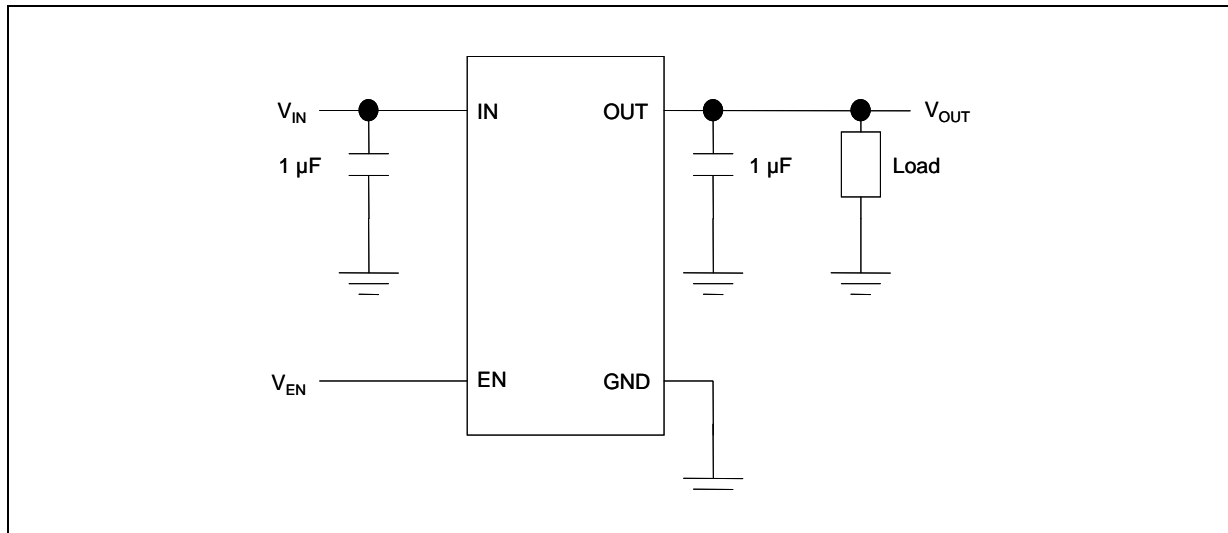


Table 2. Pin description

| Pin n° | | Symbol | Function |
|--------|----------|--------|---|
| SOT666 | SOT23-5L | | |
| 1 | 3 | EN | Enable pin logic input: low = shutdown, high = active |
| 2 | 2 | GND | Common ground |
| 3 | 1 | IN | LDO input voltage |
| 4 | 5 | OUT | Output voltage |
| 5 | 4 | NC | Not connected |
| 6 | | NC | Not connected |

3 Typical application

Figure 3. Typical application circuit



4 Maximum ratings

Table 3. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|-----------|--------------------------------------|----------------------|------|
| V_{IN} | DC input voltage | -0.3 to 7 | V |
| V_{OUT} | DC output voltage | - 0.3 to $V_I + 0.3$ | V |
| V_{EN} | Enable input voltage | - 0.3 to $V_I + 0.3$ | V |
| I_{OUT} | Output current | Internally limited | mA |
| P_D | Power dissipation | Internally limited | mW |
| T_{STG} | Storage temperature range | -65 to 150 | °C |
| T_{OP} | Operating junction temperature range | -40 to 125 | °C |

Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. All values are referred to GND.

Table 4. Thermal data

| Symbol | Parameter | SOT23-5L | SOT666 | Unit |
|------------|-------------------------------------|----------|--------|------|
| R_{thJA} | Thermal resistance junction-ambient | 255 | 132 | °C/W |
| R_{thJC} | Thermal resistance junction-case | 81 | 56 | °C/W |

5 Electrical characteristics

$T_J = 25\text{ °C}$, $V_{IN} = V_{OUT(NOM)} + 1\text{ V}$, $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$, $I_{OUT} = 1\text{ mA}$, $V_{EN} = V_{IN}$, unless otherwise specified.

Table 5. Electrical characteristics (1)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|------------------|--|--|------|----------|------|---------------------|
| V_{IN} | Operating input voltage | | 1.5 | | 5.5 | V |
| V_{UVLO} | Turn-on threshold | | | 1.45 | 1.48 | V |
| | Turn-off threshold | | 1.30 | 1.35 | | mV |
| V_{OUT} | V_{OUT} accuracy | $V_{OUT} > 1.5\text{ V}$, $I_{OUT} = 1\text{ mA}$ $T_J = 25\text{ °C}$ | -2.0 | | 2.0 | % |
| | | $V_{OUT} > 1.5\text{ V}$, $I_{OUT} = 1\text{ mA}$ $-40\text{ °C} < T_J < 125\text{ °C}$ | -3.0 | | 3.0 | |
| | | $V_{OUT} \leq 1.5\text{ V}$, $I_{OUT} = 1\text{ mA}$ | | ± 10 | | mV |
| | | $V_{OUT} \leq 1.5\text{ V}$, $I_{OUT} = 1\text{ mA}$ $-40\text{ °C} < T_J < 125\text{ °C}$ | | ± 30 | | |
| ΔV_{OUT} | Static line regulation | $V_{OUT} + 1\text{ V} \leq V_{IN} \leq 5.5\text{ V}$ $I_{OUT} = 1\text{ mA}$ | | 0.01 | | %/V |
| ΔV_{OUT} | Transient line regulation (2) | $\Delta V_{IN} = + 500\text{ mV}$, $I_{OUT} = 1\text{ mA}$ $T_R = T_F = 5\text{ }\mu\text{s}$ | | 10 | | mVpp |
| ΔV_{OUT} | Static load regulation | $I_{OUT} = 1\text{ mA}$ to 150 mA | | 0.002 | | %/mA |
| ΔV_{OUT} | Transient load regulation (2) | $I_{OUT} = 1\text{ mA}$ to 150 mA $T_R = T_F = 5\text{ }\mu\text{s}$ | | 40 | | mVpp |
| V_{DROP} | Dropout voltage (3) | $I_{OUT} = 100\text{ mA}$, $V_{OUT} > 1.5\text{ V}$ $-40\text{ °C} < T_J < 125\text{ °C}$ | | 80 | 100 | mV |
| e_N | Output noise voltage | 1.1 kHz to 100 kHz, $I_{OUT} = 10\text{ mA}$ $V_{OUT} = 0.8\text{ V}$ | | 29 | | μV_{RMS} |
| SVR | Supply voltage rejection $V_{OUT} = 1.5\text{ V}$ | $V_{IN} = V_{OUTNOM} + 0.5\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$, freq. = 1 kHz $I_{OUT} = 10\text{ mA}$ | | 65 | | dB |
| | | $V_{IN} = V_{OUTNOM} + 0.5\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$, freq.=10 kHz $I_{OUT} = 10\text{ mA}$ | | 62 | | |
| I_Q | Quiescent current | $I_{OUT} = 0\text{ mA}$ | | 18 | | μA |
| | | $I_{OUT} = 0\text{ mA}$, $-40\text{ °C} < T_J < 125\text{ °C}$ | | | 50 | |
| | | $I_{OUT} = 0$ to 150 mA | | 38 | | |
| | | $I_{OUT} = 0$ to 150 mA $-40\text{ °C} < T_J < 125\text{ °C}$ | | | 70 | |
| | | V_{IN} input current in OFF mode: $V_{EN} = \text{GND}$ | | 0.001 | 1 | |

Table 5. Electrical characteristics (continued)⁽¹⁾

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|------------|-----------------------------|---|------|------|------|------------------|
| I_{SC} | Short-circuit current | $R_L = 0$ | | 350 | | mA |
| V_{EN} | Enable input logic low | $V_{IN} = 1.5 \text{ V to } 5.5 \text{ V}$ $-40 \text{ }^\circ\text{C} < T_J < 125 \text{ }^\circ\text{C}$ | | | 0.4 | V |
| | Enable input logic high | $V_{IN} = 1.5 \text{ V to } 5.5 \text{ V}$ $-40 \text{ }^\circ\text{C} < T_J < 125 \text{ }^\circ\text{C}$ | 0.9 | | | V |
| I_{EN} | Enable pin input current | $V_{EN} = V_{IN}$ | | 0.1 | 100 | nA |
| T_{ON} | Turn-on time ⁽⁴⁾ | | | 30 | | μs |
| T_{SHDN} | Thermal shutdown | | | 160 | | $^\circ\text{C}$ |
| | Hysteresis | | | 20 | | |
| C_{OUT} | Output capacitor | Capacitance (see typical performance characteristics for stability) | 1 | | 22 | μF |

1. For $V_{OUT(NOM)} < 1.2 \text{ V}$, $V_{IN} = 1.5 \text{ V}$
2. All transient values are guaranteed by design, not production tested
3. Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value. This specification does not apply to output voltages below 1.5 V
4. Turn-on time is the time measured between the enable input just exceeding V_{EN} high value and the output voltage just reaching 95% of its nominal value

6 Typical performance characteristics

Figure 4. Output voltage vs. temperature

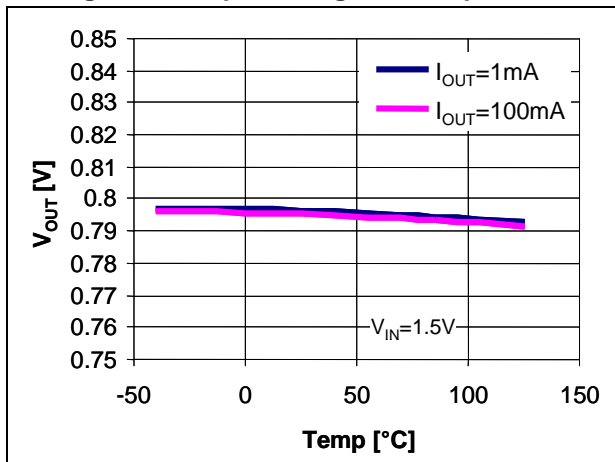


Figure 5. Output voltage vs. input voltage

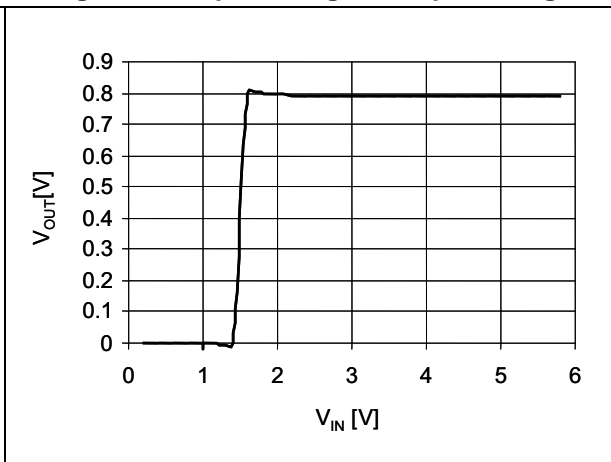


Figure 6. Dropout voltage vs. output current

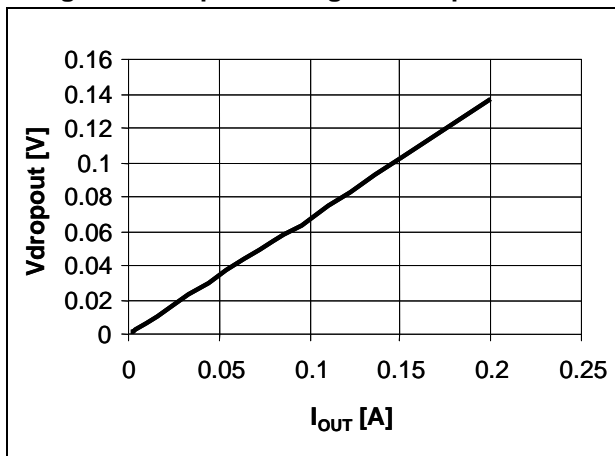


Figure 7. C_OUT stability region

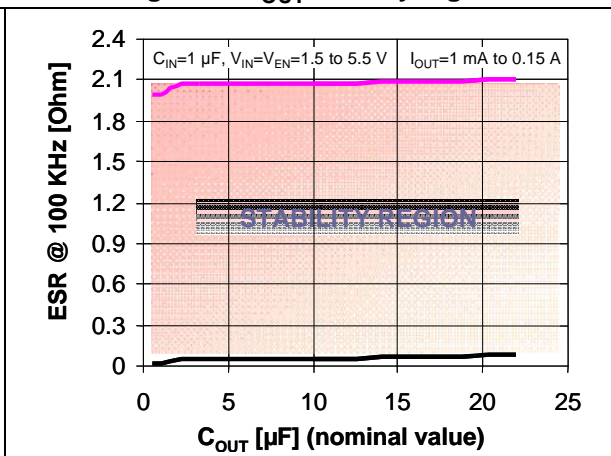


Figure 8. Supply voltage rejection vs. frequency

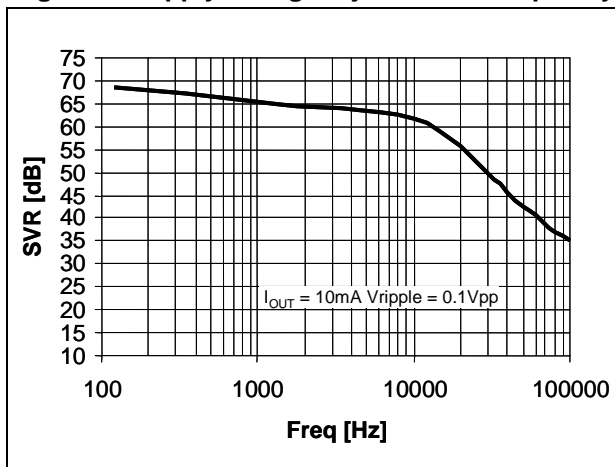


Figure 9. Output noise voltage vs. frequency

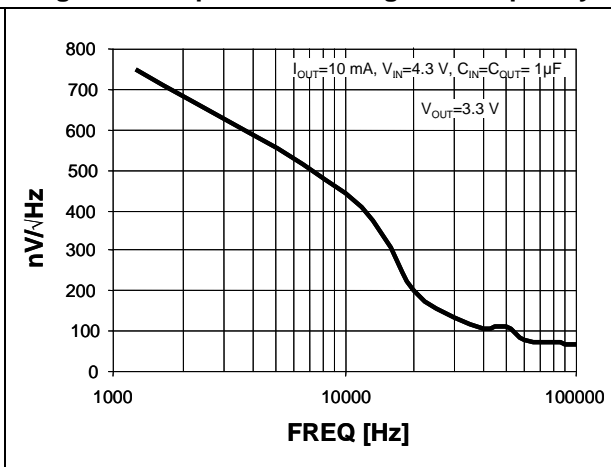


Figure 10. Quiescent current vs. input voltage

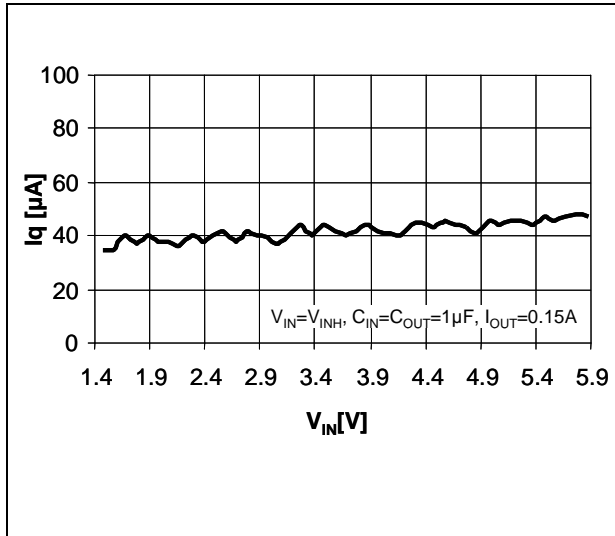


Figure 11. Load transient

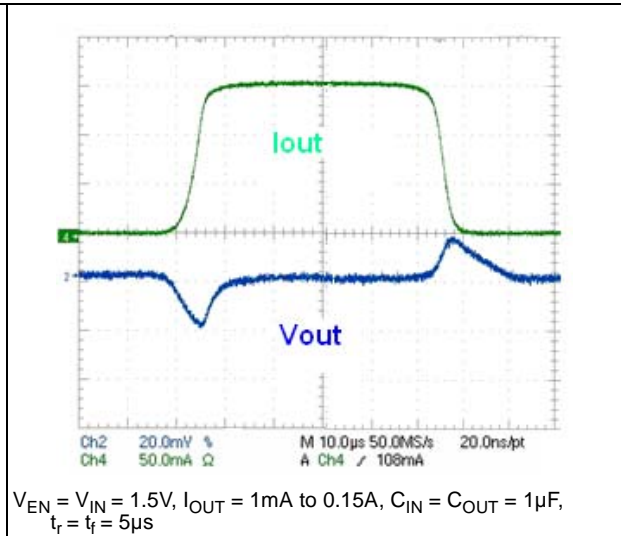


Figure 12. Line transient

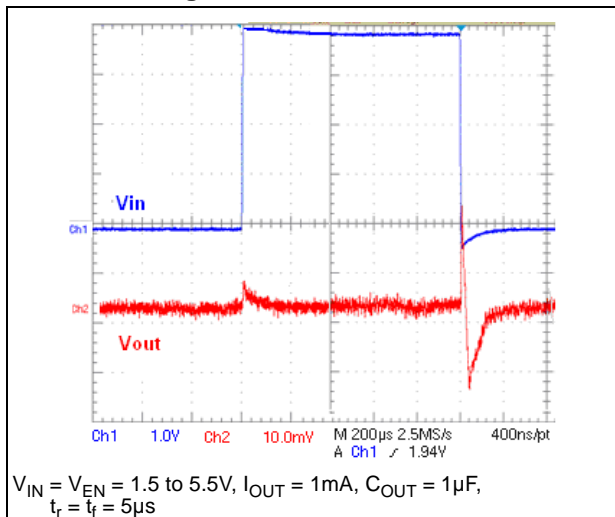
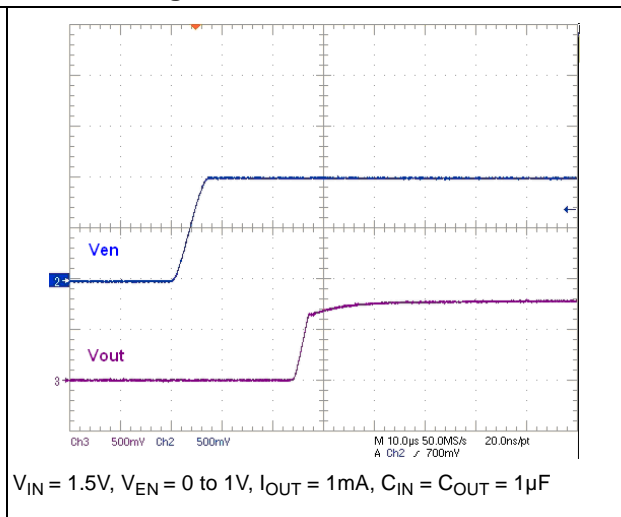


Figure 13. Enable transient



7 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 14. SOT23-5L mechanical drawings

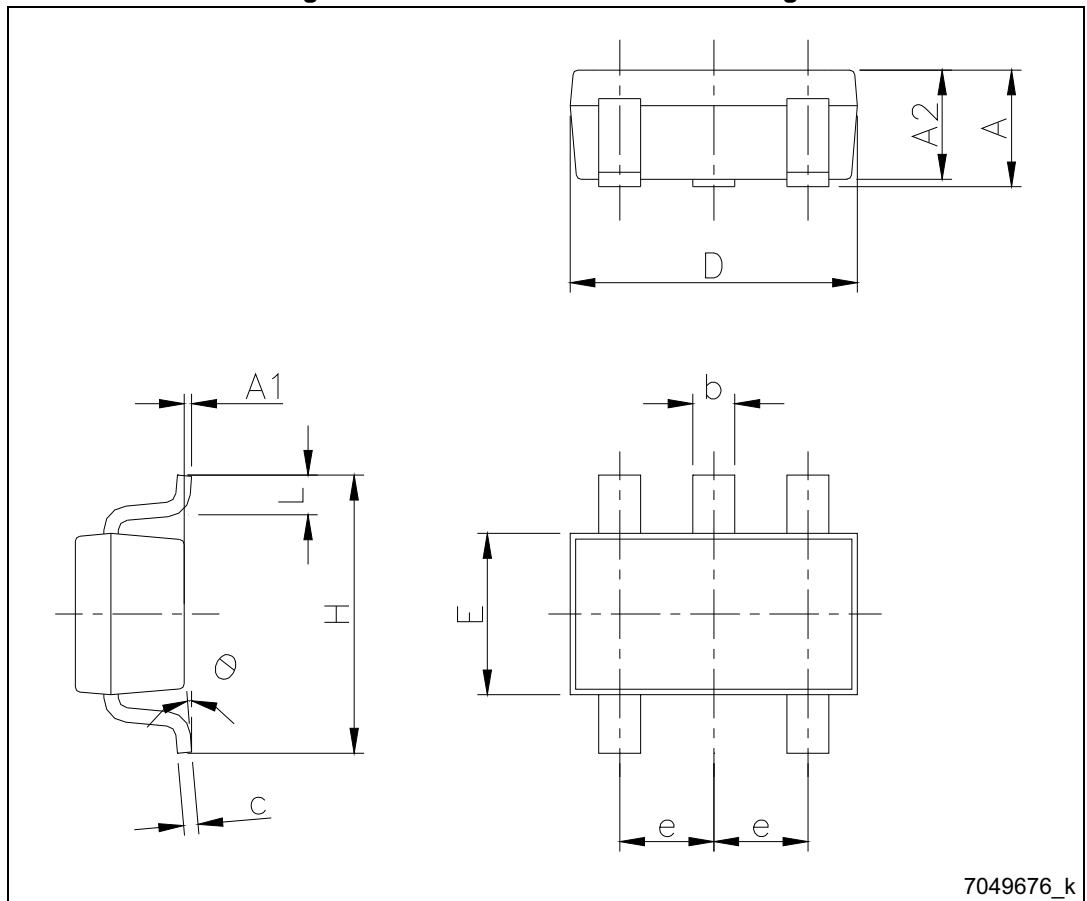


Table 6. SOT23-5L mechanical data

| 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 | 0.09 | | 0.20 |
| D | | 2.95 | |
| E | | 1.60 | |
| e | | 0.95 | |
| H | | 2.80 | |
| L | 0.30 | | 0.60 |
| θ | 0 | | 8 |

Figure 15. SOT23-5L recommended footprint (dimensions in mm)

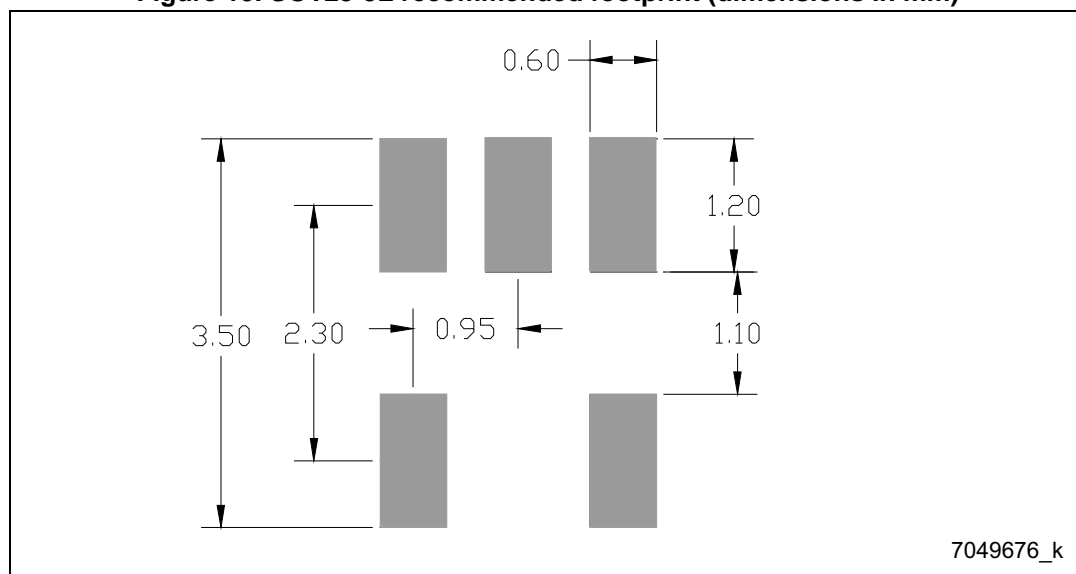


Figure 16. SOT666 mechanical drawings

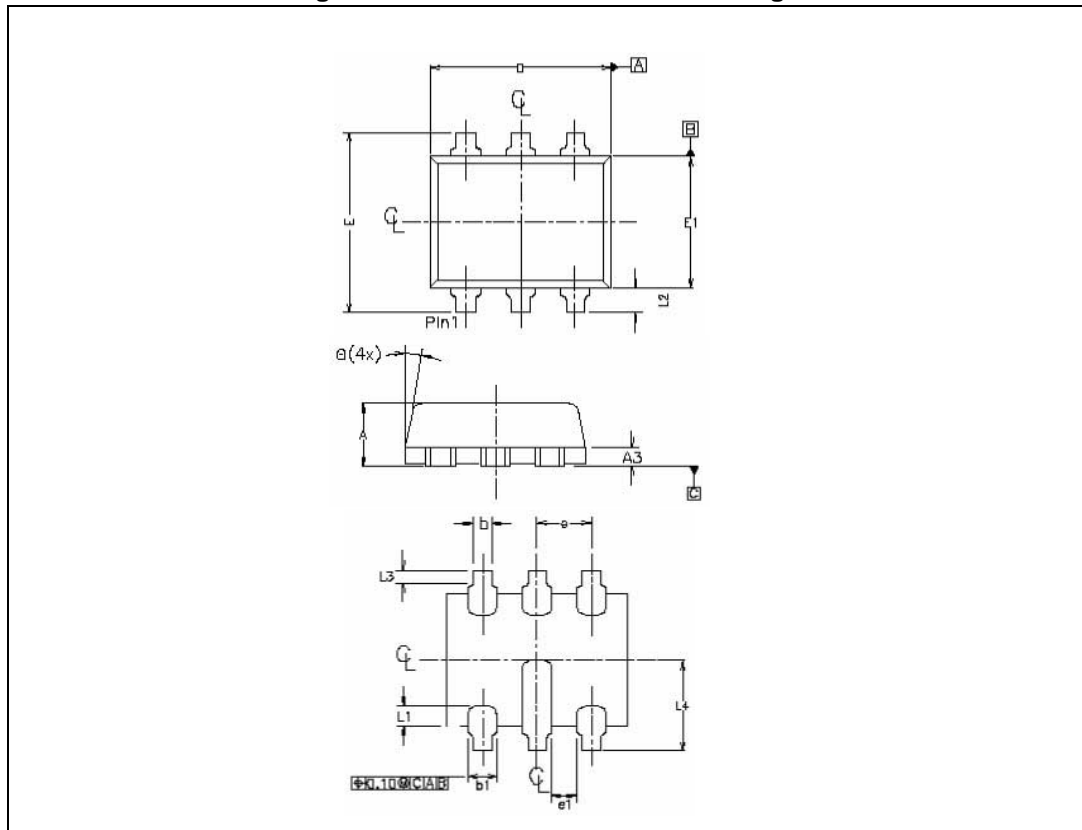


Table 7. SOT666 mechanical data

| Dim. | mm | | |
|----------|------|------|------|
| | Min. | Typ. | Max. |
| A | 0.53 | 0.57 | 0.60 |
| A3 | 0.13 | 0.17 | 0.18 |
| D | 1.50 | 1.66 | 1.70 |
| E | 1.50 | 1.65 | 1.70 |
| E1 | 1.10 | 1.20 | 1.30 |
| L1 | 0.11 | 0.19 | 0.26 |
| L2 | 0.10 | 0.23 | 0.30 |
| L3 | 0.05 | 0.10 | |
| b | 0.17 | | 0.25 |
| b1 | | 0.27 | 0.34 |
| e | | 0.50 | |
| e1 | 0.20 | | |
| θ | 8° | 10° | 12° |

8 Packaging mechanical data

Figure 17. Tape and reel SOT23-5L drawings

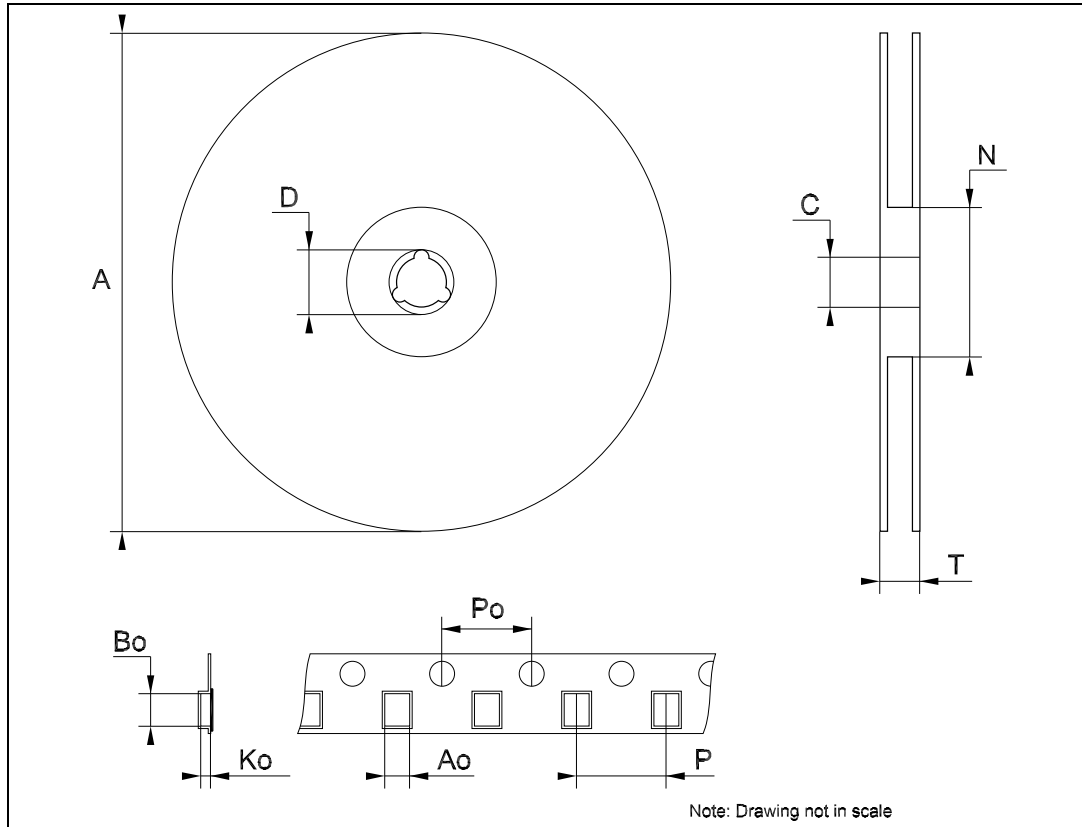


Table 8. Tape and reel SOT23-5L mechanical data

| 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 |

9 Revision history

Table 9. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 13-Nov-2007 | 1 | Initial release. |
| 11-Apr-2008 | 2 | Modified: Table 5 on page 7 . |
| 12-Feb-2009 | 3 | Modified: Table 1 on page 1 . |
| 11-Feb-2014 | 4 | Part number LD39015xx changed to LD39015. Updated the Description in cover page and Section 7: Package mechanical data . Added Section 8: Packaging mechanical data . Minor text changes. |

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

ST PRODUCTS ARE NOT DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER'S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR "AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL" INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2014 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com