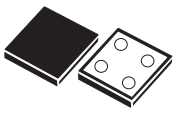
# LD39015Jxx

## 150 mA low quiescent current low noise voltage regulator

## Features

- Input voltage from 1.5 to 5.5 V
- Ultra low dropout voltage (90 mV typ. at 100 mA load)
- Very low quiescent current (20 µA typ. at no load, 35 µA typ. at 150 mA load, 1 µA max in off mode)
- Low noise (54 $\mu V_{RMS}$ from 10 Hz to 100 kHz at $V_{OUT}$ = 1.8 V)
- Output voltage tolerance: ± 2.0% @ 25 °C
- 150 mA guaranteed output current
- Wide range of output voltages available on request: 0.8 V to 4.5 V with 100 mV step
- Logic-controlled electronic shutdown
- Compatible with ceramic capacitor $C_{OUT}$ = 1 µF
- Internal current and thermal limit
- Flip-chip 4 bumps 1.1 x 1.1 mm.
- Temperature range: -40 °C to 125 °C



**Flip-chip 4**

## Description

The LD39015Jxx provides 150 mA maximum current from an input voltage ranging from 1.5 V to 5.5 V with a typical dropout voltage of 80 mV. It is stable with ceramic capacitor. 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 74 dB at low frequencies and starts to roll off at 10 kHz. Enable logic control function puts the LD39015Jxx in shut-down mode allowing a total current consumption lower than 1 µA. The device also includes a short-circuit constant current limiting and thermal protection. Typical applications are mobile phones, personal digital assistant (PDAs), cordless phone and similar battery powered systems.

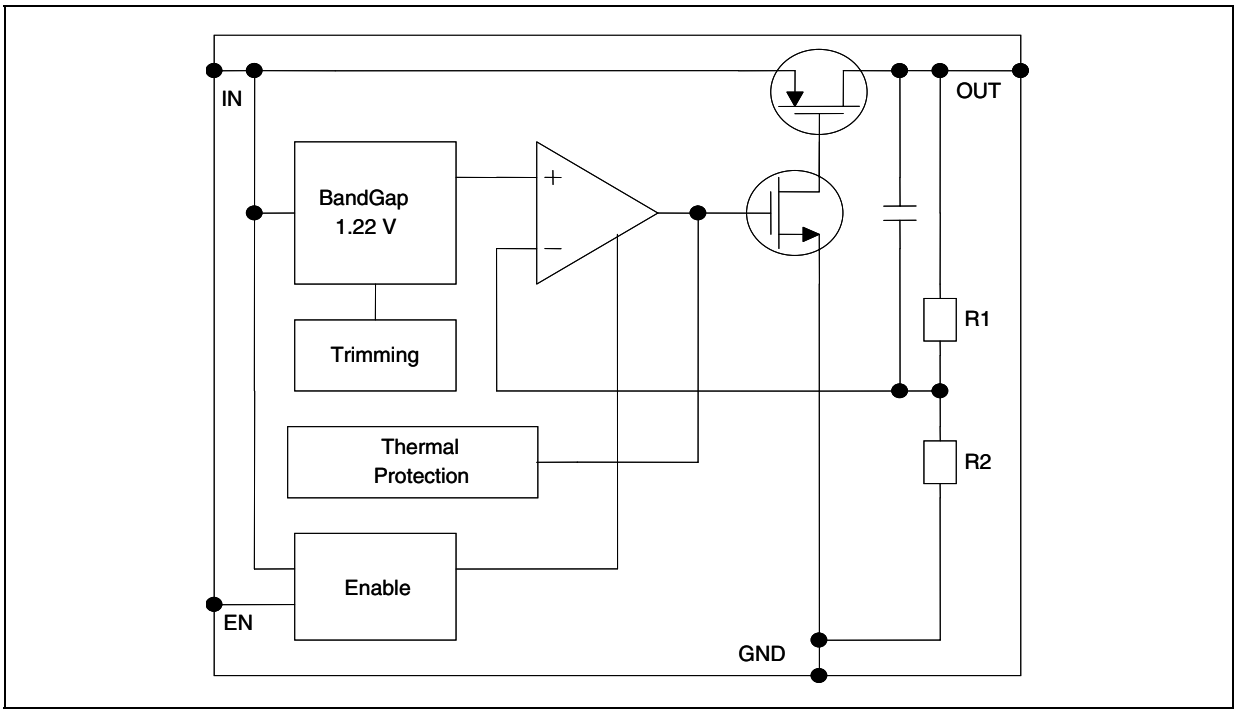
**Table 1. Device summary**

| Part numbers | Order codes | Output voltages |
|---|---|---|
| LD39015JXX12 | LD39015J12R | 1.2 V |
| LD39015JXX13 | LD39015JJ13R | 1.3 V |
| LD39015JXX15 | LD39015J15R | 1.5 V |
| LD39015JXX18 | LD39015J18R | 1.8 V |
| LD39015JXX28 | LD39015J28R | 2.8 V |

# Contents

# 1 Diagram

**Figure 1. Block diagram**



# 2 Pin configuration

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

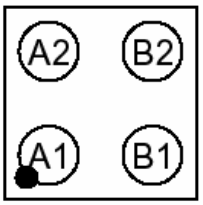
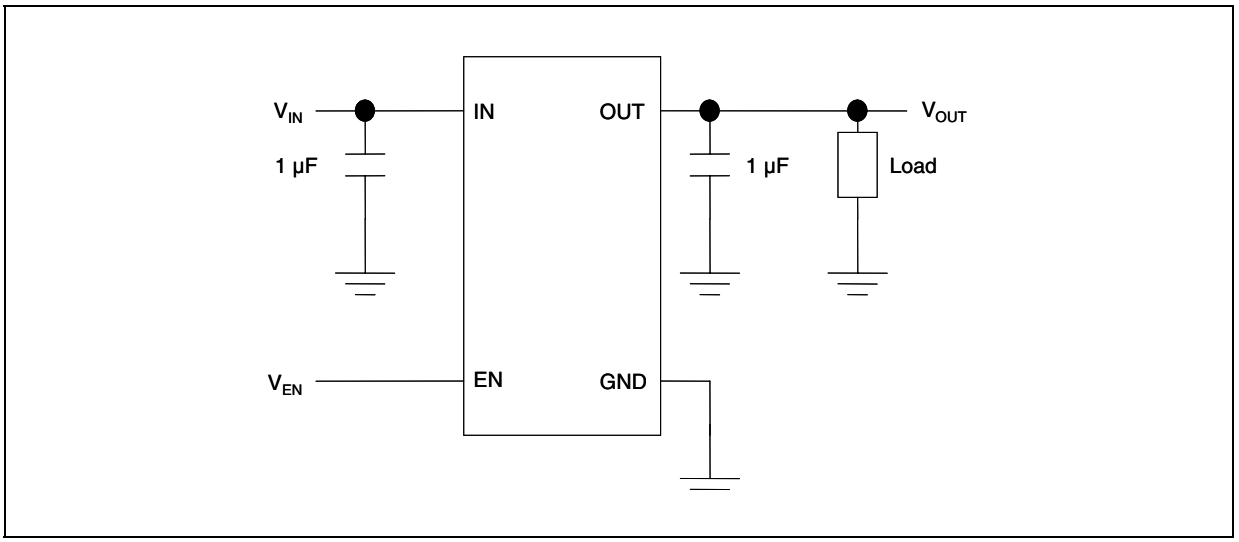



**Table 2. Pin description**

| Pin n° | Symbol | Function |
|---|---|---|
| A2 | EN | Enable pin logic input: Low=shutdown, High=active |
| A1 | GND | Common ground |
| B2 | IN | Input voltage of the LDO |
| B1 | OUT | Output voltage |

# 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 6 | 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 | Value | Unit |
|---|---|---|---|
| $R_{thJA}$ | Thermal resistance junction-ambient | 180 | °C/W |

# 5 Electrical characteristics

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

**Table 5. Electrical characteristics**

| 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 | $V_{OUT}$ > 1.5V, $I_{OUT}$ = 1mA, $T_J$ = 25°C | -2.0 | | 2.0 | % |
| | | $V_{OUT}$ > 1.5V, $I_{OUT}$ = 1mA, -40°C < $T_J$ < 125°C | -3.0 | | 3.0 | |
| | | $V_{OUT}$ ≤ 1.5V, $I_{OUT}$ = 1mA | | ±10 | | mV |
| | | $V_{OUT}$ ≤ 1.5V, $I_{OUT}$ = 1mA, -40°C < $T_J$ < 125°C | | ±30 | | |
| $\Delta V_{OUT}$ | Static line regulation | $V_{OUT}$ +1V ≤ $V_{IN}$ ≤ 5.5V, $I_{OUT}$ = 1mA | | 0.01 | | %/V |
| $\Delta V_{OUT}$ | Static load regulation | $I_{OUT}$ = 1mA to 150mA | | 0.002 | | %/mA |
| $V_{DROP}$ | Dropout voltage (1) | $I_{OUT}$ = 100mA, $V_{OUT}$ > 1.5V -40°C < $T_J$ < 125°C | | 90 | 130 | mV |
| $e_N$ | Output noise voltage | 10Hz to 100kHz, $I_{OUT}$ = 10mA, $V_{OUT}$ = 1.8V, $V_{IN}$ = 2.8V | | 54 | | $\mu V_{RMS}$ |
| SVR | Supply voltage rejection $V_{OUT}$ = 1.5V | $V_{IN}$ = $V_{OUTNOM}$ + 1V +/-$V_{RIPPLE}$ $V_{RIPPLE}$ = 0.1V, freq. = 1kHz $I_{OUT}$ = 10mA | | 74 | | dB |
| | | $V_{IN}$ = $V_{OUTNOM}$ + 0.5V +/-$V_{RIPPLE}$ $V_{RIPPLE}$ = 0.1V, Freq.=10kHz $I_{OUT}$ = 10mA | | 67 | | |
| $I_Q$ | Quiescent current | $I_{OUT}$ = 0mA | | 20 | | µA |
| | | $I_{OUT}$ = 0mA, -40°C < $T_J$ < 125°C | | | 40 | |
| | | $I_{OUT}$ = 0 to 150mA | | 35 | | |
| | | $I_{OUT}$ = 0 to 150mA -40°C < $T_J$< 125°C | | | 50 | |
| | | $V_{IN}$ input current in OFF MODE: $V_{EN}$ = GND | | 0.003 | 1 | |
| $I_{SC}$ | Short circuit current | $R_L$ = 0 | 200 | | | mA |
| $V_{EN}$ | Enable input logic low | $V_{IN}$ = 1.5V to 5.5V, -40°C < $T_J$ < 125°C | | | 0.4 | V |
| | Enable input logic high | $V_{IN}$ = 1.5V to 5.5V, -40°C < $T_J$ < 125°C | 0.9 | | | V |
| $I_{EN}$ | Enable pin input current | $V_{SHDN}$ = $V_{IN}$, -40°C < $T_J$ < 125°C | | 0.1 | 1 | µA |
| $T_{ON}$ | Turn on time (2) | | | 30 | | µs |

**Table 5. Electrical characteristics (continued)**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $T_{SHDN}$ | Thermal shutdown | | | 160 | | °C |
| | Hysteresis | | | 20 | | |
| $C_{OUT}$ | Output capacitor | Capacitance (see typical performance characteristics for stability) | 1 | | 22 | µF |

1. 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 for output voltages below 1.5 V.
2. Turn-on time is 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**

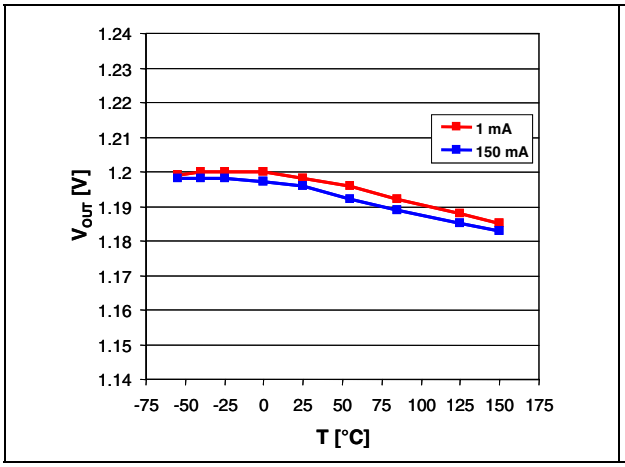



**Figure 5. Output voltage vs. input voltage**

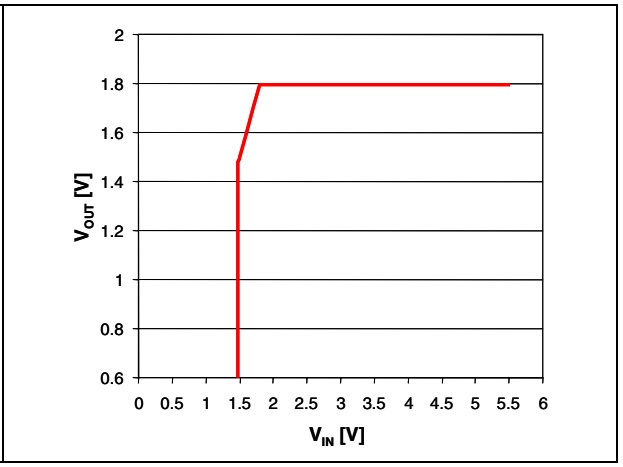



**Figure 6. Dropout voltage vs. output current**

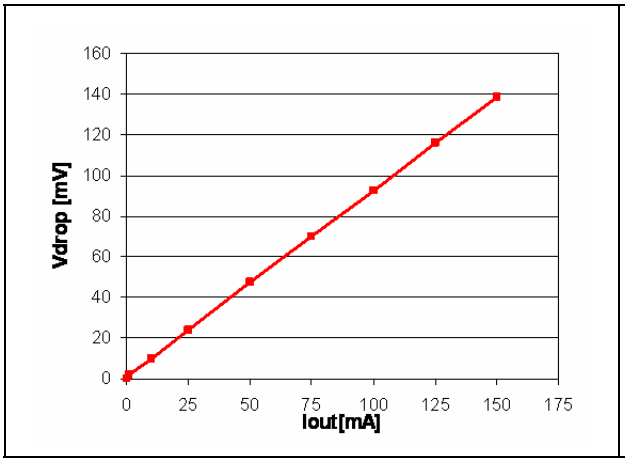



**Figure 7. $C_{OUT}$ stability region**

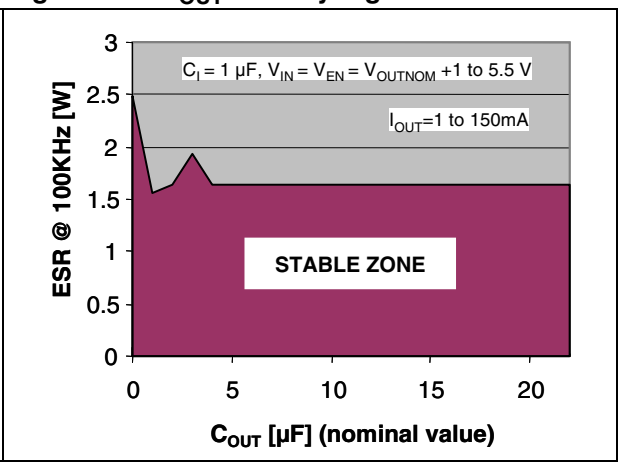



**Figure 8. Supply voltage rejection vs. frequency**

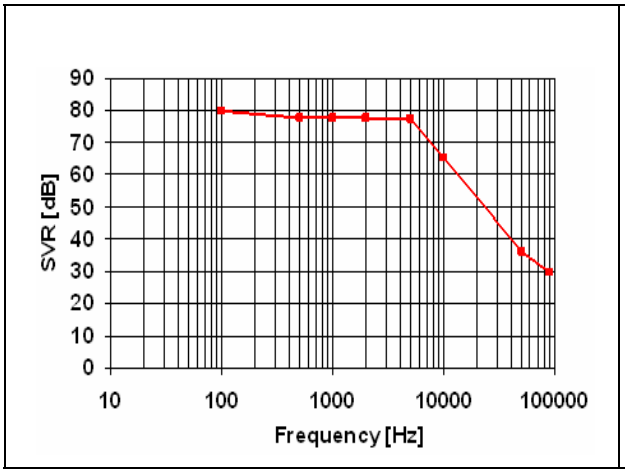



**Figure 9. Output noise spectral density**

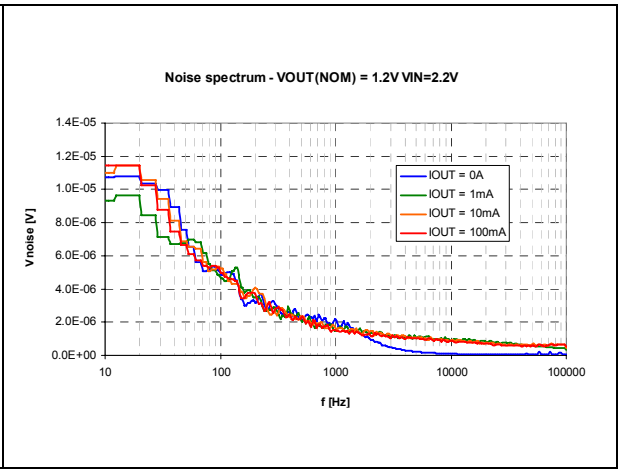


**Figure 10. SVR vs. drop**

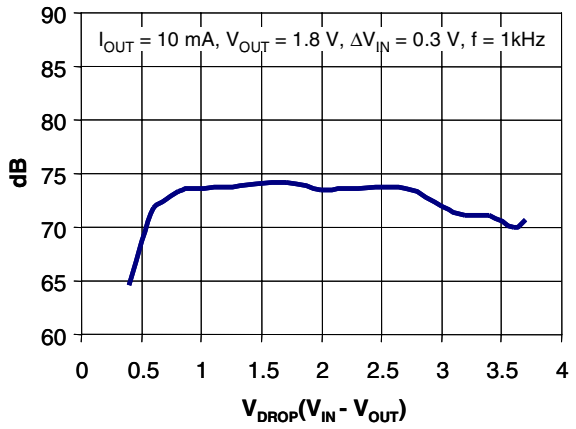



**Figure 11. Quiescent current vs. $I_{OUT}$**

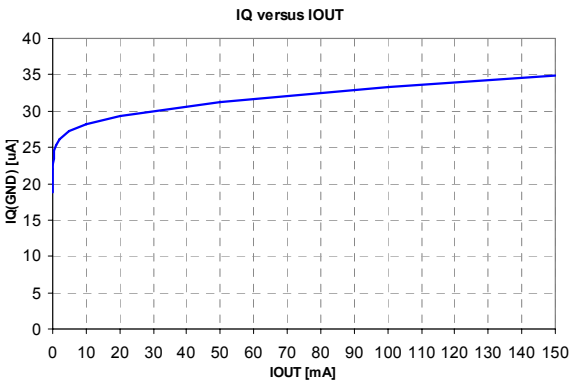



**Figure 12. Quiescent current vs. input voltage**

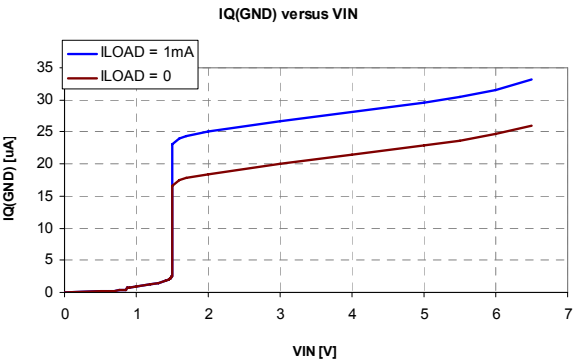
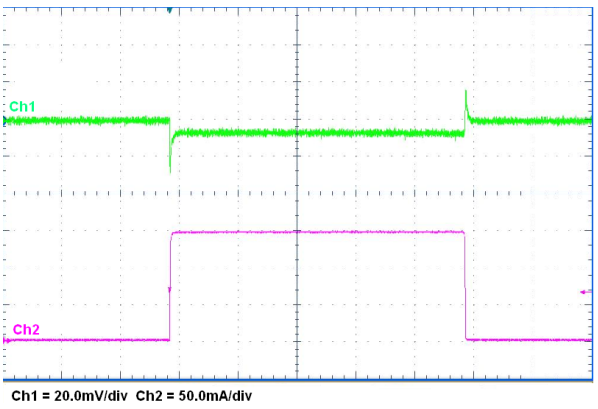
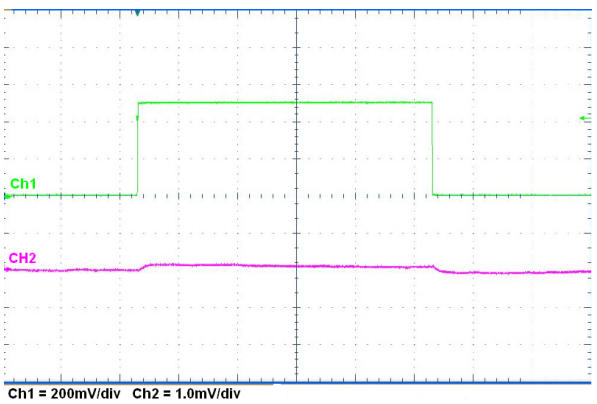



**Figure 13. Load transient**



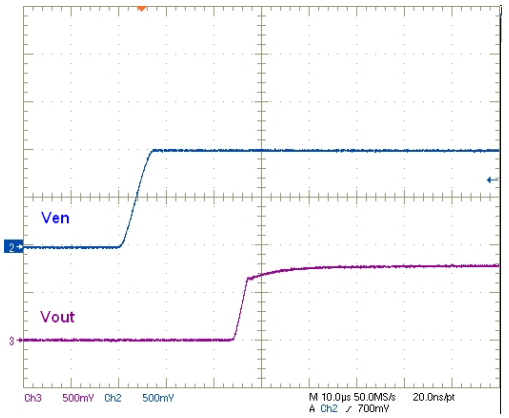

$I_{OUT}$ = 10mA to 150mA, $t_r = t_f$ = 5µs

**Figure 14. Line transient**




$I_{OUT}$ = 10 mA; $V_{OUT}$= 1.8 V; $\Delta V_{IN}$ = 0.5 V; $V_{IN}$ = from 2.550 to 3.055V; $T_r = T_f$ = 5 µs

**Figure 15. Enable transient**



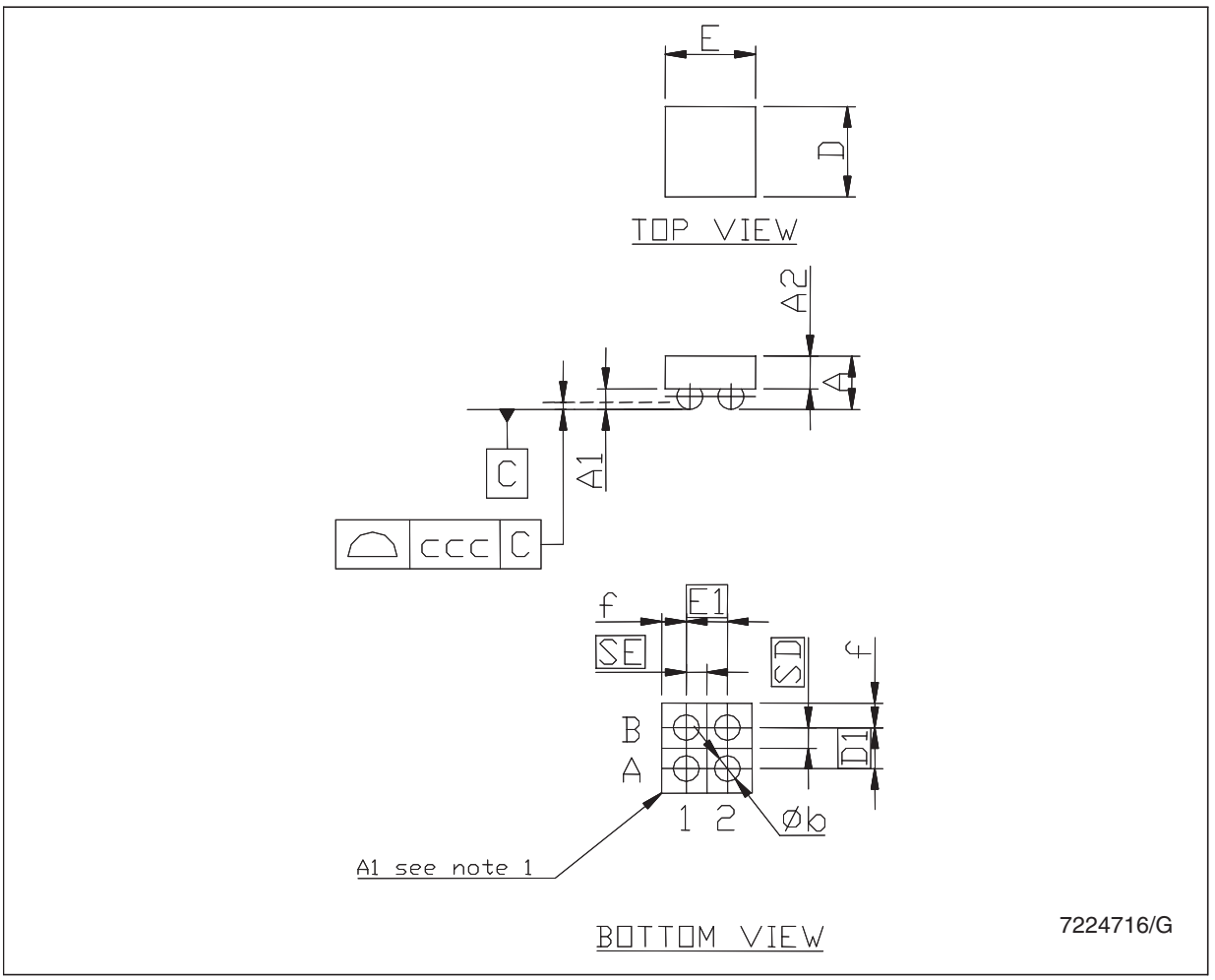

$V_{IN}$ = 1.5 V, $V_{EN}$ = 0 to 1 V, $I_{OUT}$ = 1 mA, $C_{IN} = C_{OUT}$ = 1 µF

# 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.

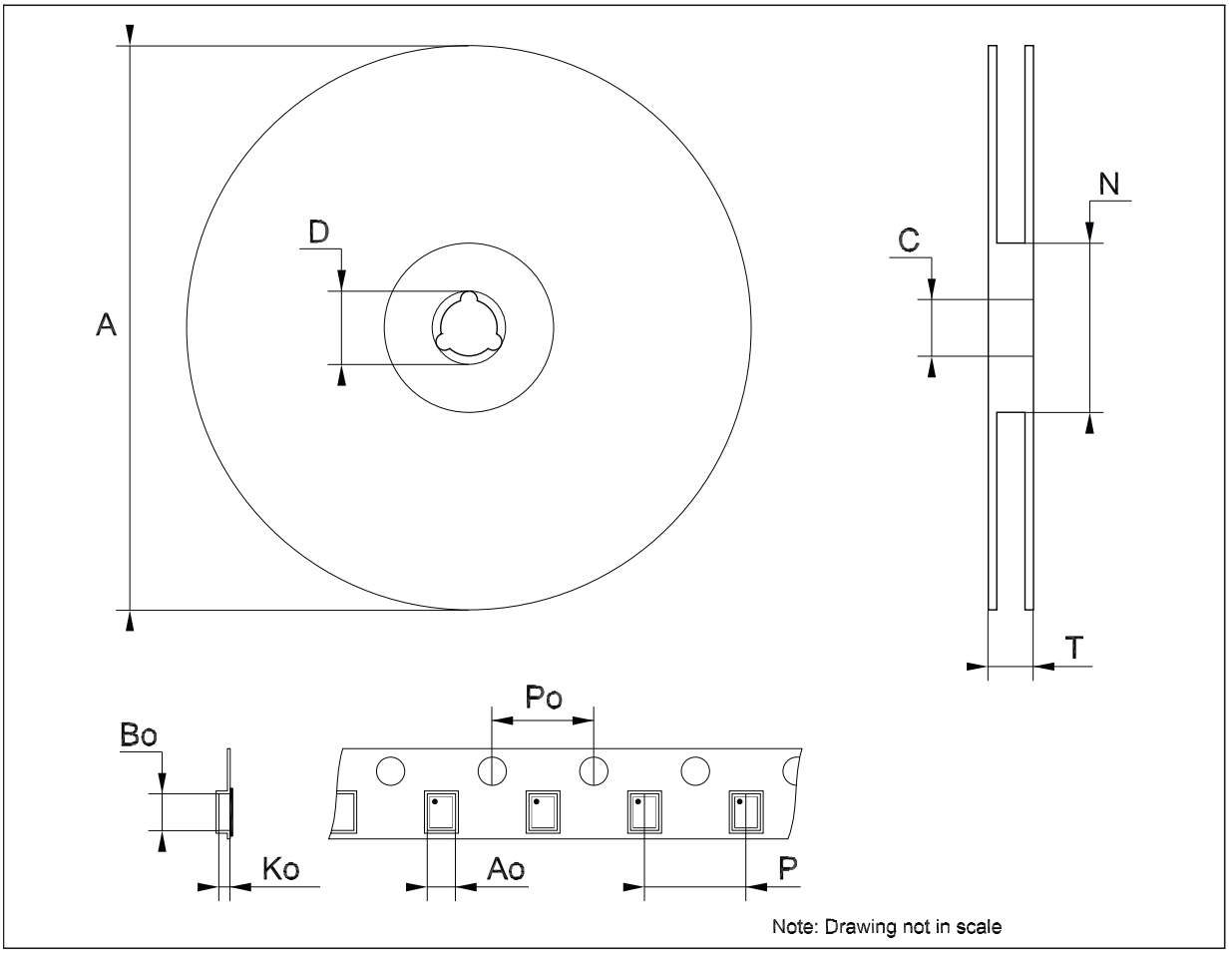
## Flip-chip 4 mechanical data

| Dim. | mm. | | | mils. | | |
|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 0.585 | 0.65 | 0.715 | 23.03 | 25.59 | 28.15 |
| A1 | 0.21 | 0.25 | 0.29 | 8.27 | 9.84 | 11.42 |
| A2 | | 0.40 | | | 15.75 | |
| b | 0.265 | 0.315 | 0.365 | 10.43 | 12.40 | 14.37 |
| D | 1.02 | 1.07 | 1.12 | 40.15 | 42.13 | 44.09 |
| D1 | | 0.5 | | | 19.69 | |
| E | 1.02 | 1.07 | 1.12 | 40.15 | 42.13 | 44.09 |
| E1 | | 0.5 | | | 19.69 | |
| SD | | 0.25 | | | 9.84 | |
| SE | | 0.25 | | | 9.84 | |



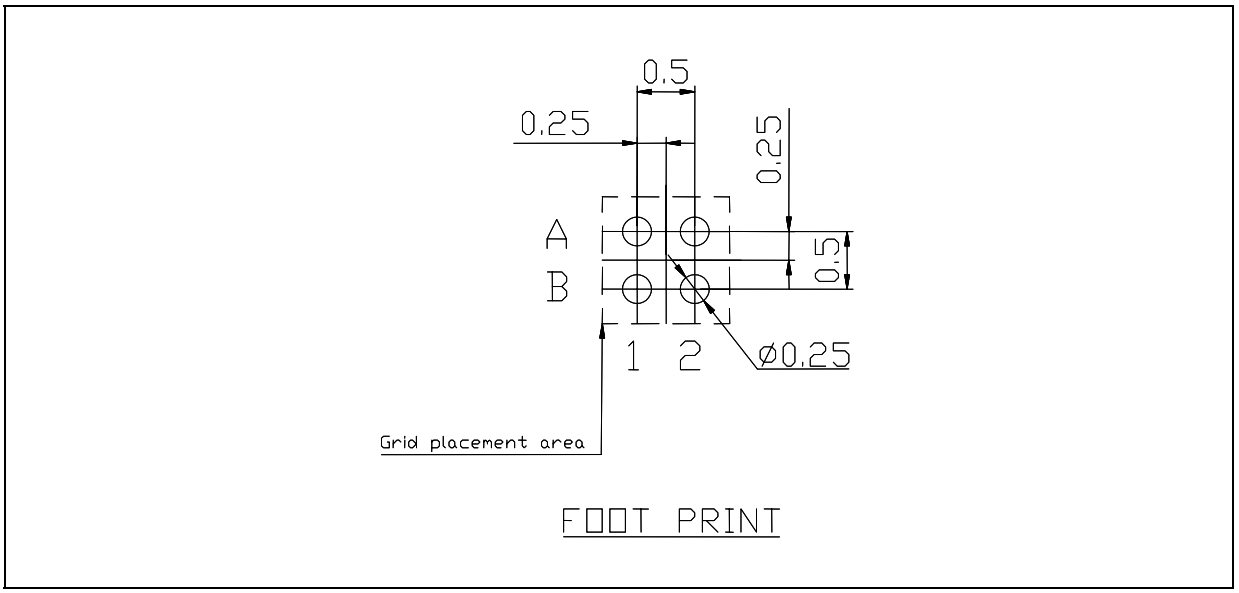
## Tape and reel Flip-chip 4 mechanical data

| Dim. | mm. | | | inch. | | |
|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 178 | | | 6.926 |
| C | 12.8 | | 13.2 | 0.504 | | 0.519 |
| D | 20.2 | | | 0.795 | | |
| N | 59 | 60 | 61 | 2.323 | 2.362 | 2.401 |
| T | | | 8.4 | | | 0.331 |
| Ao | 1.12 | 1.17 | 1.22 | 0.044 | 0.046 | 0.048 |
| Bo | 1.12 | 1.17 | 1.22 | 0.044 | 0.046 | 0.048 |
| Ko | 0.68 | 0.73 | 0.78 | 0.027 | 0.029 | 0.031 |
| Po | 3.9 | 4 | 4.1 | 0.153 | 0.157 | 0.161 |
| P | 3.9 | 4 | 4.1 | 0.153 | 0.157 | 0.161 |




Note: Drawing not in scale

**Figure 16. Foot print data**



# 8 Different output voltage versions of the LD39015Jxx available on request

**Table 6. Options available on request**

| Order codes | Output voltages |
|---|---|
| LD39015J08R | 0.8 V |
| LD39015J10R | 1.0 V |
| LD39015J33R | 3.3 V |

# 9 Revision history

**Table 7. Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 29-Jun-2009 | 1 | First release. |
| 05-Aug-2009 | 2 | Updated tape and reel mechanical data *on page 13*. |

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