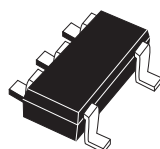


## 150 mA low noise high PSRR linear voltage regulator

Datasheet - production data



SOT323-5L

### Features

- Input voltage from 2.4 to 5.5 V
- Very low quiescent current (31  $\mu$ A typ. at no-load, 75  $\mu$ A typ. at 150 mA load, 1  $\mu$ A max. in OFF mode)
- Very low noise (20  $\mu$ V<sub>RMS</sub> at  $V_{OUT} = 1.5$  V)
- Output voltage tolerance:  $\pm 1.8\%$  at 25 °C
- 150 mA guaranteed output current
- Wide range of output voltages available on request: 1.2 V to 3.3 V in 100 mV steps
- Logic-controlled electronic shutdown
- Compatible with ceramic capacitors
- Very high PSRR (80 dB @ 100 Hz, 76 @ 10 kHz, 54 @ 100 kHz)
- Internal current and thermal limit
- Package: SOT323-5L
- Temperature range: -40 °C to 125 °C

### Description

The LD59015 provides 150 mA maximum current with an input voltage range from 2.4 V to 5.5 V, and a typical dropout voltage of 150 mV. It is stable with ceramic capacitors. High PSRR, low quiescent current and low noise features make it suitable for low power battery-powered applications. Power supply rejection is 80 dB at low frequency and starts to roll off at 10 kHz. The enable logic control function puts the LD59015 in shutdown mode, allowing a total current consumption lower than 1  $\mu$ A. The device also includes short-circuit constant current limiting and thermal protection. Typical applications are mobile phones, personal digital assistants (PDAs), cordless phones and similar battery-powered systems.

Table 1. Device summary

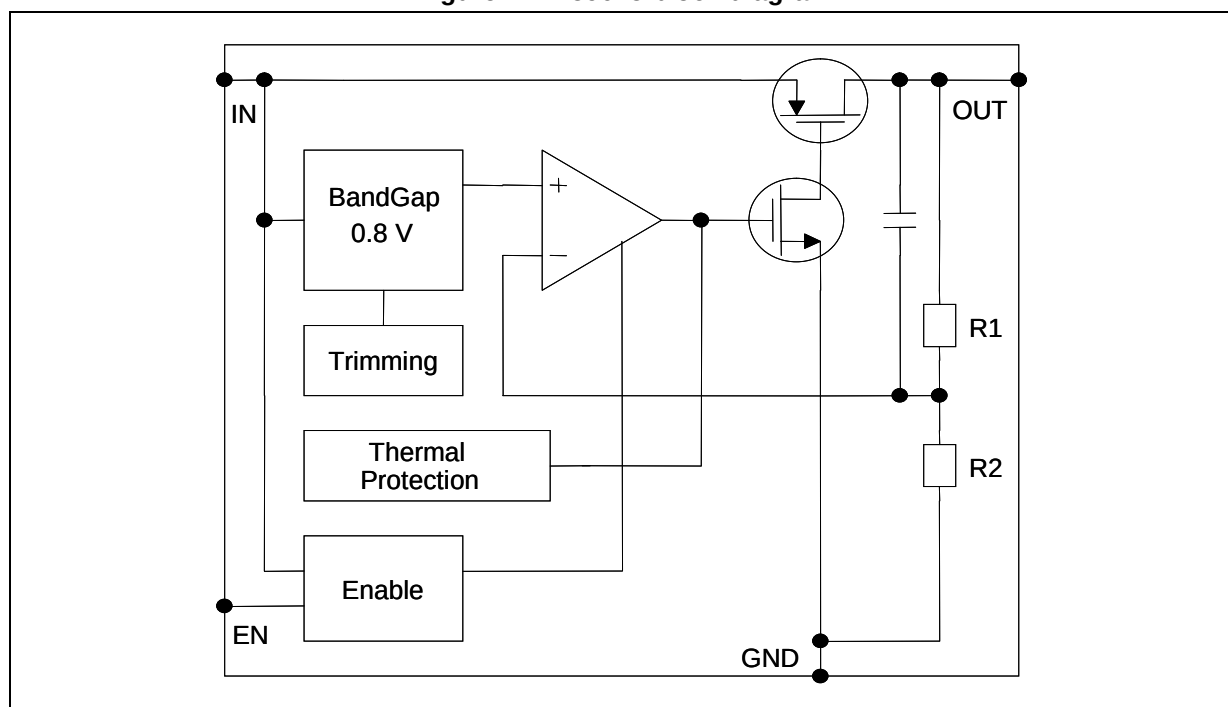
| Order code  | Output voltages |
|-------------|-----------------|
| LD59015C12R | 1.2 V           |
| LD59015C15R | 1.5 V           |
| LD59015C18R | 1.8 V           |
| LD59015C25R | 2.5 V           |
| LD59015C30R | 3.0 V           |
| LD59015C33R | 3.3 V           |

## Contents

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# 1 Block diagram

Figure 1. LD59015 block diagram



## 2 Pin configuration

Figure 2. Pin connection (top view)

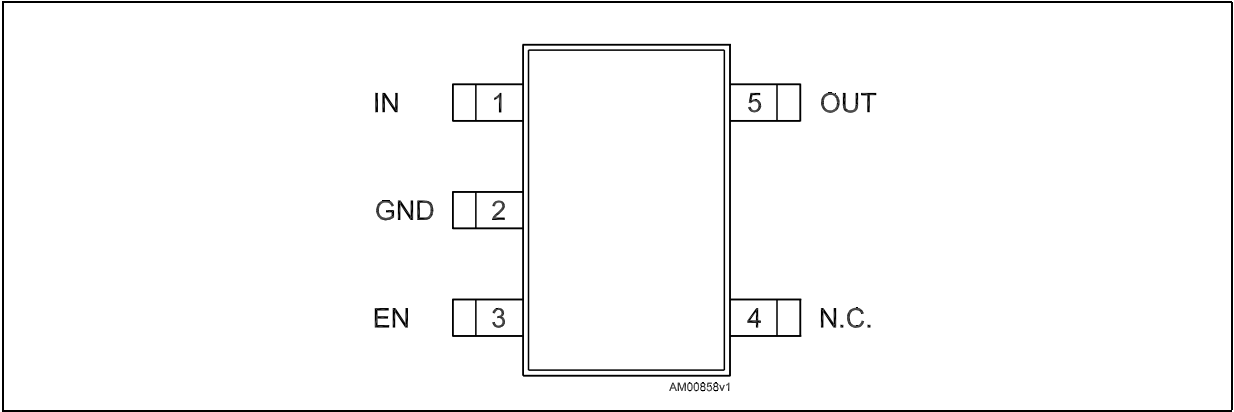
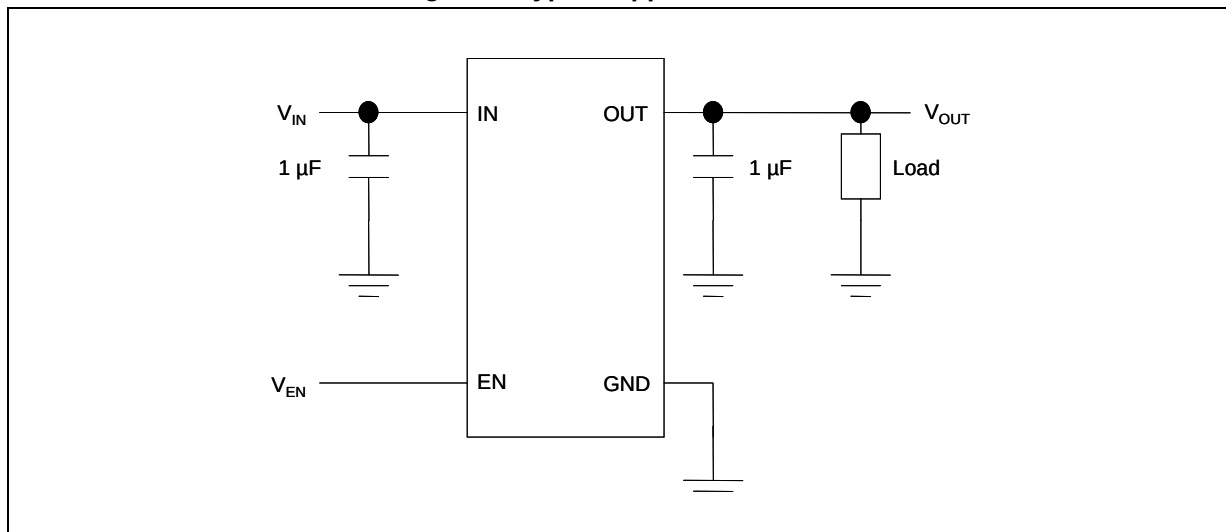


Table 2. Pin description

| Pin | Symbol | Function                                                                                              |
|-----|--------|-------------------------------------------------------------------------------------------------------|
| 1   | IN     | Input voltage                                                                                         |
| 2   | GND    | Ground                                                                                                |
| 3   | EN     | Enable input<br>Set $V_{EN} > 0.9$ to turn on the device<br>Set $V_{EN} < 0.4$ to turn off the device |
| 4   | N.C.   | Not connected                                                                                         |
| 5   | 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 7                    | V    |
| $V_{OUT}$ | DC output voltage                    | - 0.3 to $V_I + 0.3$ (max. 7) | V    |
| $V_{EN}$  | Enable input voltage                 | - 0.3 to $V_I + 0.3$ (max. 7) | V    |
| $I_{OUT}$ | Output current                       | Internally limited            | mA   |
| $P_D$     | Power dissipation                    | Internally limited            | mW   |
| ESD       | Human body model                     | $\pm 3$                       | kV   |
|           | Machine model                        | $\pm 300$                     | V    |
| $T_{STG}$ | 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 | 645.69 | °C/W |
| $R_{thJC}$ | Thermal resistance junction-case    | 116    | °C/W |

## 5 Electrical characteristics

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

**Table 5. Electrical characteristics (1)**

| Symbol           | Parameter                                            | Test conditions                                                                                                                      | Min. | Typ.  | Max. | Unit                             |
|------------------|------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|------|-------|------|----------------------------------|
| $V_{IN}$         | Operating input voltage                              |                                                                                                                                      | 2.4  |       | 5.5  | V                                |
| $V_{UVLO}$       | Turn-on threshold                                    |                                                                                                                                      |      | 2.0   | 2.15 |                                  |
|                  | Turn-off threshold                                   |                                                                                                                                      | 1.90 | 1.95  |      |                                  |
| $V_{OUT}$        | $V_{OUT}$ accuracy                                   | $I_{OUT} = 1\text{ mA}$ , $-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$                                          | -1.8 |       | 1.8  | %                                |
| $\Delta V_{OUT}$ | Static line regulation                               | $V_{OUT} + 1\text{ V} \leq V_{IN} \leq 5.5\text{ V}$ , $I_{OUT} = 1\text{ mA}$                                                       |      | 0.001 |      | %/V                              |
| $\Delta V_{OUT}$ | Static load regulation                               | $I_{OUT} = 1\text{ mA}$ to $150\text{ mA}$                                                                                           |      | 0.001 |      | %/mA                             |
| $V_{DROP}$       | Dropout voltage (2)                                  | $I_{OUT} = 150\text{ mA}$ , $V_{OUT} > 2.2\text{ V}$<br>$-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$            |      | 150   | 210  | mV                               |
| $e_N$            | Output noise voltage                                 | 10 Hz to 100 kHz, $I_{OUT} = 10\text{ mA}$ ,<br>$V_{OUT} = 1.5\text{ V}$                                                             |      | 20    |      | $\mu\text{V}_{RMS}$<br>$N_{OUT}$ |
| SVR              | Supply voltage rejection<br>$V_{OUT} = 1.5\text{ V}$ | $V_{IN} = V_{OUTNOM} + 1\text{ V} \pm V_{RIPPLE}$<br>$V_{RIPPLE} = 0.5\text{ V}$ , frequency = 1 kHz<br>$I_{OUT} = 1\text{ mA}$      |      | 76    |      | dB                               |
|                  |                                                      | $V_{IN} = V_{OUTNOM} + 1\text{ V} \pm V_{RIPPLE}$<br>$V_{RIPPLE} = 0.5\text{ V}$ ,<br>frequency = 10 kHz<br>$I_{OUT} = 1\text{ mA}$  |      | 76    |      |                                  |
|                  |                                                      | $V_{IN} = V_{OUTNOM} + 1\text{ V} \pm V_{RIPPLE}$<br>$V_{RIPPLE} = 0.5\text{ V}$ ,<br>frequency = 100 kHz<br>$I_{OUT} = 1\text{ mA}$ |      | 54    |      |                                  |
| $I_Q$            | Quiescent current                                    | $I_{OUT} = 0\text{ mA}$                                                                                                              |      | 31    |      | $\mu\text{A}$                    |
|                  |                                                      | $I_{OUT} = 0\text{ mA}$ , $-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$                                          |      |       | 60   |                                  |
|                  |                                                      | $I_{OUT} = 0$ to $150\text{ mA}$                                                                                                     |      | 75    |      |                                  |
|                  |                                                      | $I_{OUT} = 0$ to $150\text{ mA}$<br>$-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$                                |      |       | 110  |                                  |
|                  |                                                      | $V_{IN}$ input current in OFF mode:<br>$V_{EN} = \text{GND}$                                                                         |      | 0.001 | 1    |                                  |
| $I_{SC}$         | Short-circuit current                                | $R_L = 0$                                                                                                                            | 200  |       |      | mA                               |
| $V_{EN}$         | Enable input logic low                               | $V_{IN} = 2.4\text{ V}$ to $5.5\text{ V}$ ,<br>$-40\text{ }^{\circ}\text{C} < T_J < 85\text{ }^{\circ}\text{C}$                      |      |       | 0.4  | V                                |
|                  | Enable input logic high                              | $V_{IN} = 2.4\text{ V}$ to $5.5\text{ V}$ ,<br>$-40\text{ }^{\circ}\text{C} < T_J < 85\text{ }^{\circ}\text{C}$                      | 0.9  |       |      | V                                |

Table 5. Electrical characteristics (continued)<sup>(1)</sup>

| Symbol     | Parameter                   | Test conditions                              | Min. | Typ. | Max. | Unit |
|------------|-----------------------------|----------------------------------------------|------|------|------|------|
| $I_{EN}$   | Enable pin input current    | $V_{SHDN} = 5.5V$                            |      | 0.1  | 100  | nA   |
| $T_{ON}$   | Turn-on time <sup>(3)</sup> |                                              |      | 200  |      | μs   |
| $T_{SHDN}$ | Thermal shutdown            |                                              |      | 160  |      | °C   |
|            | Hysteresis                  |                                              |      | 20   |      |      |
| $C_{OUT}$  | Output capacitor            | Capacitance (see <a href="#">Section 6</a> ) | 1    |      | 4.7  | μF   |

1. For  $V_{OUT(NOM)} < 1.3 V$ ,  $V_{IN} = 2.4 V$ .

2. 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 1.7 V.

3. 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.

**Note:** *All transient values are guaranteed by design, not tested in production.*



## 6 Typical performance characteristics

$$C_{IN} = C_{OUT} = 1 \mu F$$

Figure 4.  $V_{OUT}$  vs. temperature ( $V_{OUT} = 0.8 \text{ V}$ )

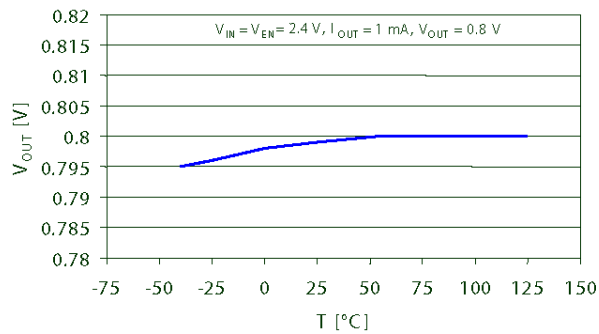


Figure 5.  $V_{OUT}$  vs. temperature ( $V_{OUT} = 3.3 \text{ V}$ )

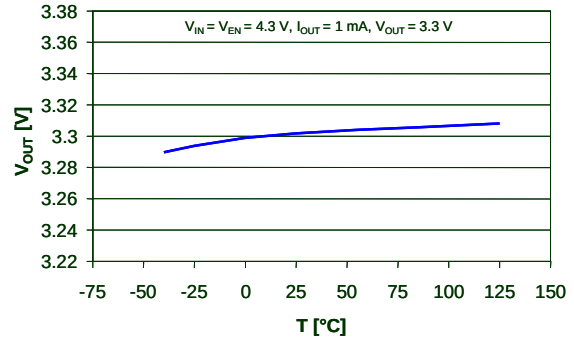


Figure 6. Quiescent current vs. temperature

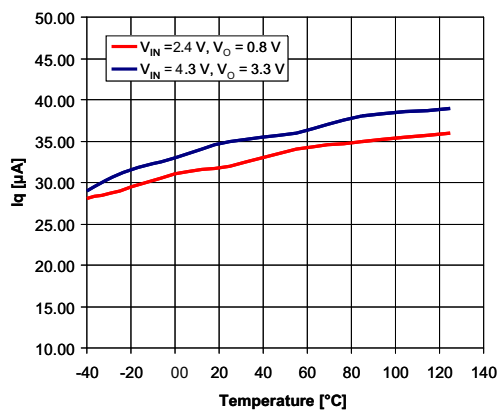


Figure 7. Quiescent current vs.  $I_{OUT}$

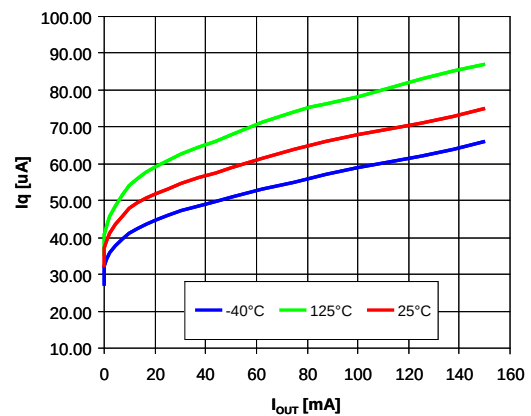


Figure 8.  $V_{OUT}$  vs.  $V_{IN}$

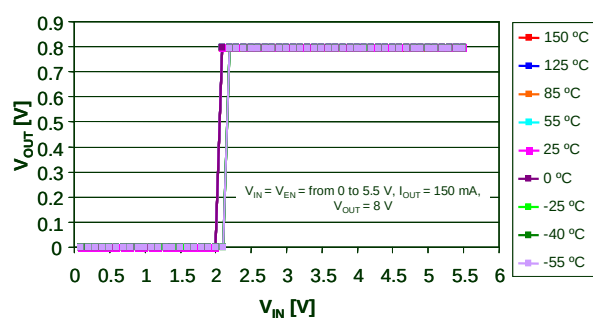
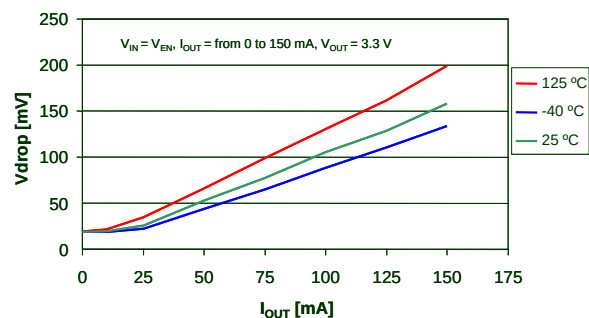


Figure 9.  $V_{DROP}$  vs.  $I_{OUT}$



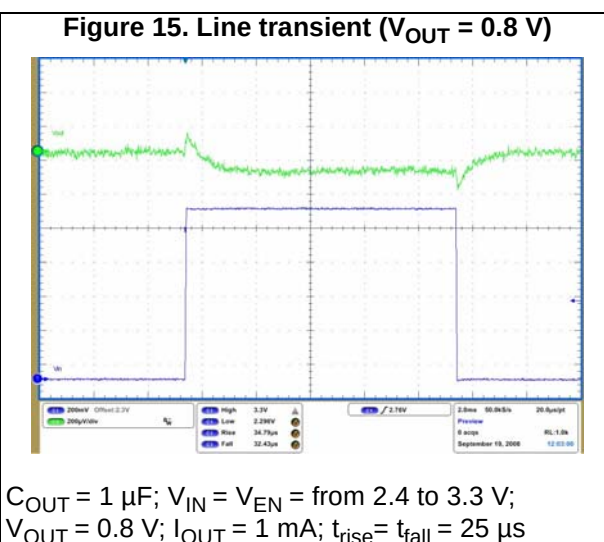
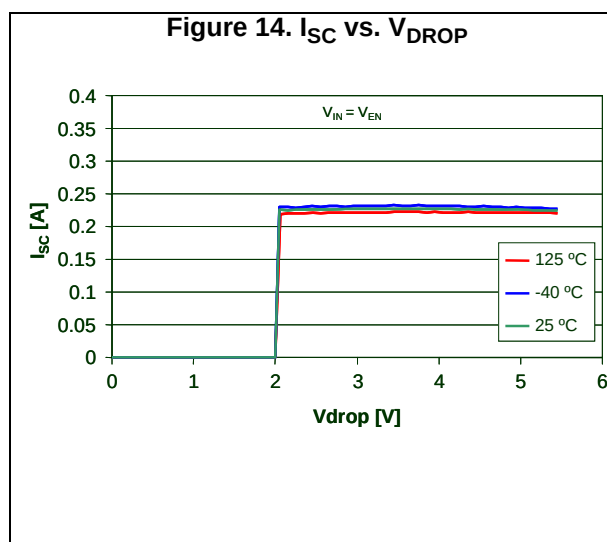
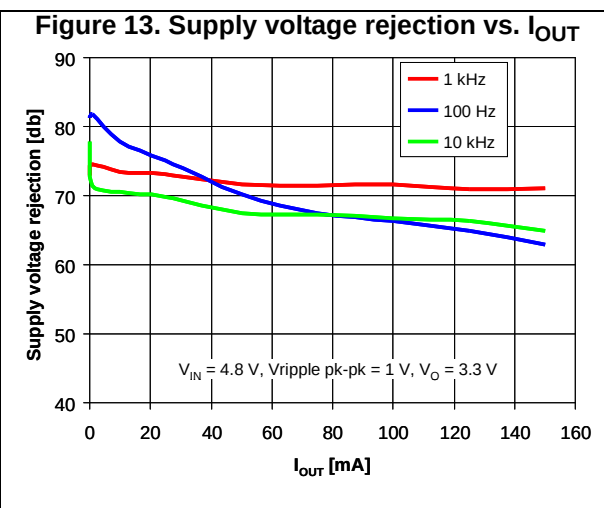
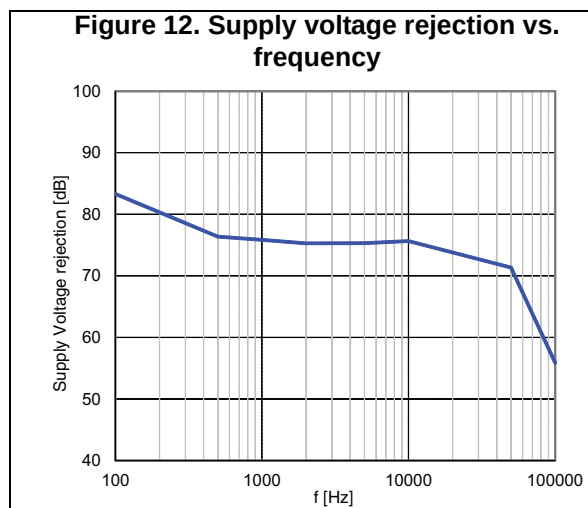
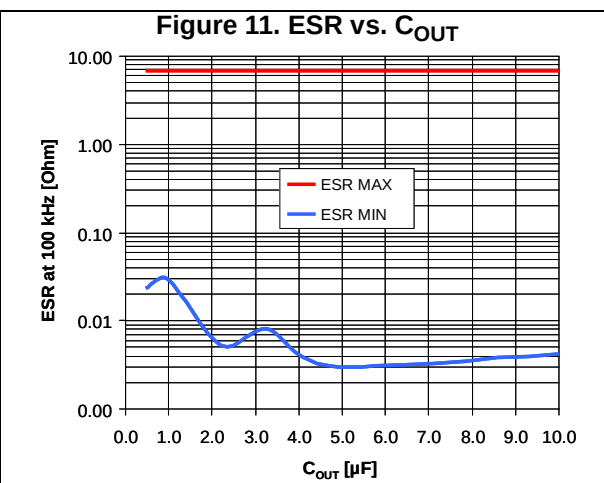
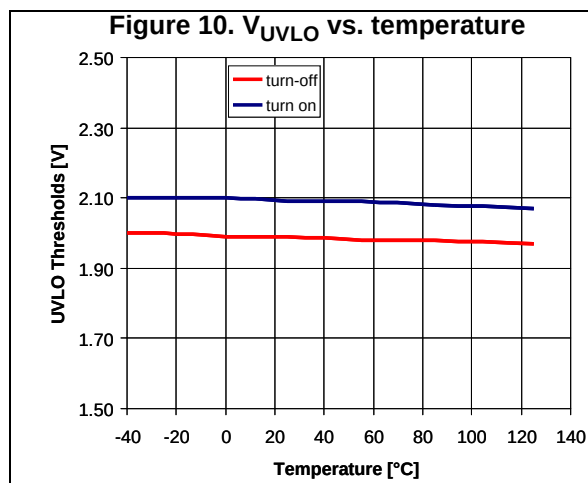
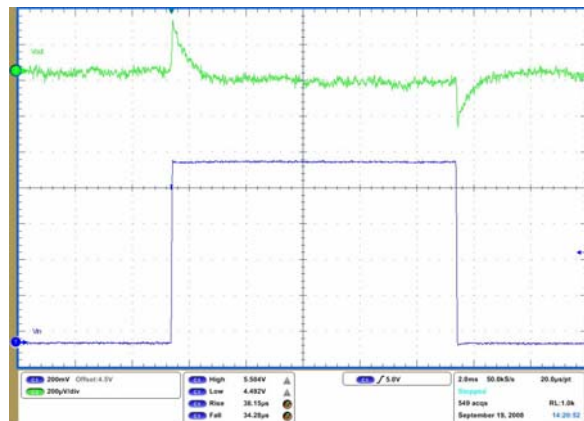
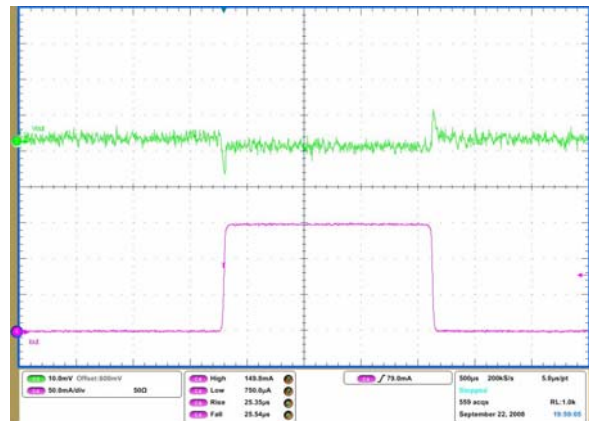
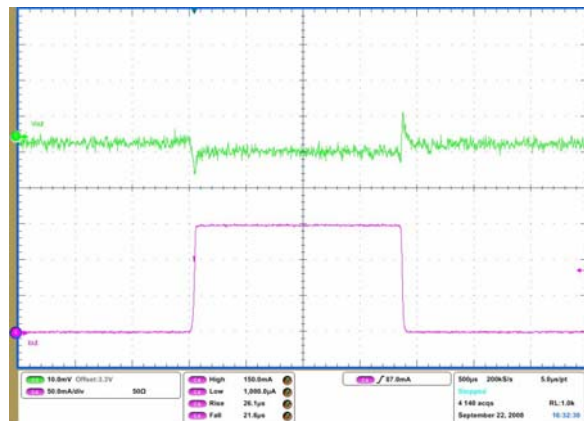


Figure 16. Line transient ( $V_{OUT} = 3.3\text{ V}$ )

$C_{OUT} = 1\text{ }\mu\text{F}$ ;  $V_{IN} = V_{EN} = \text{from } 4.5\text{ to } 5.5\text{ V}$ ;  $V_{OUT} = 3.3\text{ V}$ ;  $I_{OUT} = 1\text{ mA}$ ;  $t_{rise} = t_{fall} = 25\text{ }\mu\text{s}$

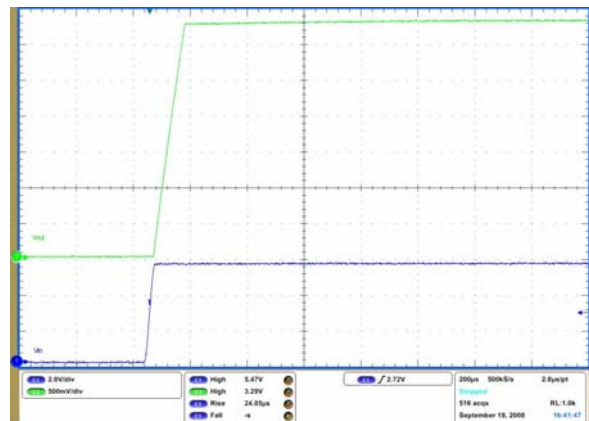
Figure 17. Load transient ( $V_{OUT} = 0.8\text{ V}$ )

$C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ ;  $V_{IN} = V_{EN} = 2.4\text{ V}$ ;  $V_{OUT} = 0.8\text{ V}$ ;  $I_{OUT}$  from  $0.1$  to  $150\text{ mA}$ ;  $t_{rise} = t_{fall} = 25\text{ }\mu\text{s}$

Figure 18. Load transient ( $V_{OUT} = 3.3\text{ V}$ )

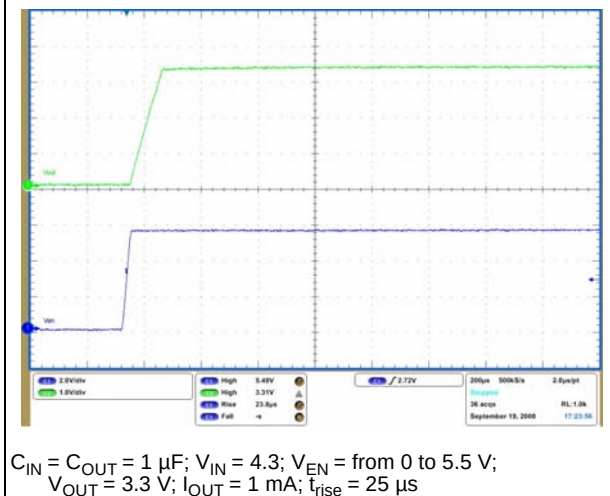
$C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ ;  $V_{IN} = V_{EN} = 4.3\text{ V}$ ;  $V_{OUT} = 3.3\text{ V}$ ;  $I_{OUT}$  from  $0.1$  to  $150\text{ mA}$ ;  $t_{rise} = t_{fall} = 25\text{ }\mu\text{s}$

Figure 19. Start-up transient



$C_{OUT} = 1\text{ }\mu\text{F}$ ;  $V_{IN} = V_{EN} = \text{from } 0\text{ to } 5.5\text{ V}$ ;  $V_{OUT} = 3.3\text{ V}$ ;  $I_{OUT} = 150\text{ mA}$

Figure 20. Enable transient



## 7 Package information

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](http://www.st.com). ECOPACK® is an ST trademark.

### 7.1 SOT323-5L package information

Figure 21. SOT323-5L package outline

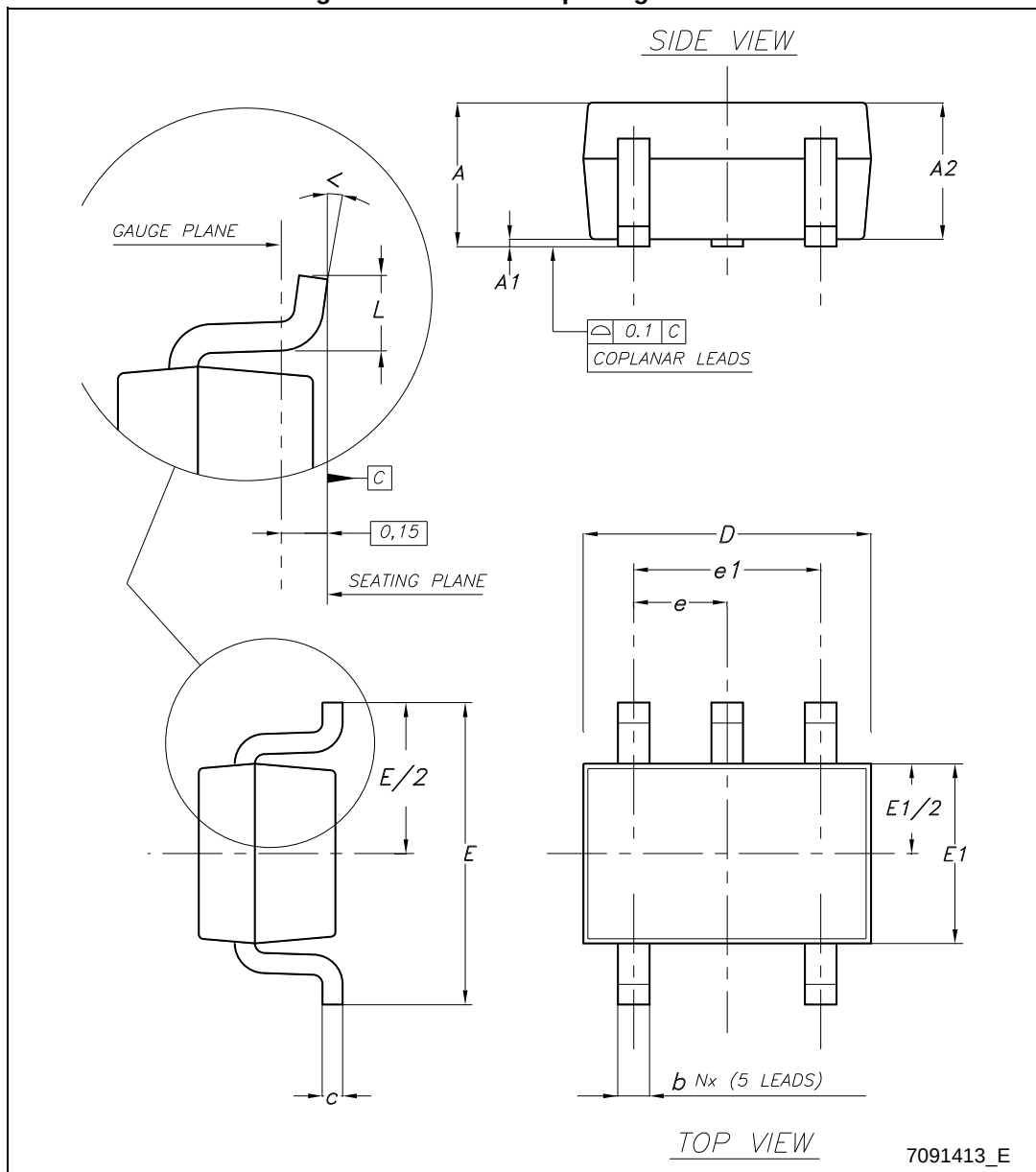


Table 6. SOT323-5L package mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    | 0.80 |      | 1.10 |
| A1   | 0    |      | 0.10 |
| A2   | 0.80 | 0.90 | 1    |
| b    | 0.15 |      | 0.30 |
| c    | 0.10 |      | 0.22 |
| D    | 1.80 | 2    | 2.20 |
| E    | 1.80 | 2.10 | 2.40 |
| E1   | 1.15 | 1.25 | 1.35 |
| e    |      | 0.65 |      |
| e1   |      | 1.30 |      |
| L    | 0.26 | 0.36 | 0.46 |
| <    | 0°   |      | 8°   |

## 7.2 SOT323-5L packing information

Figure 22. SOT323-5L tape and reel outline

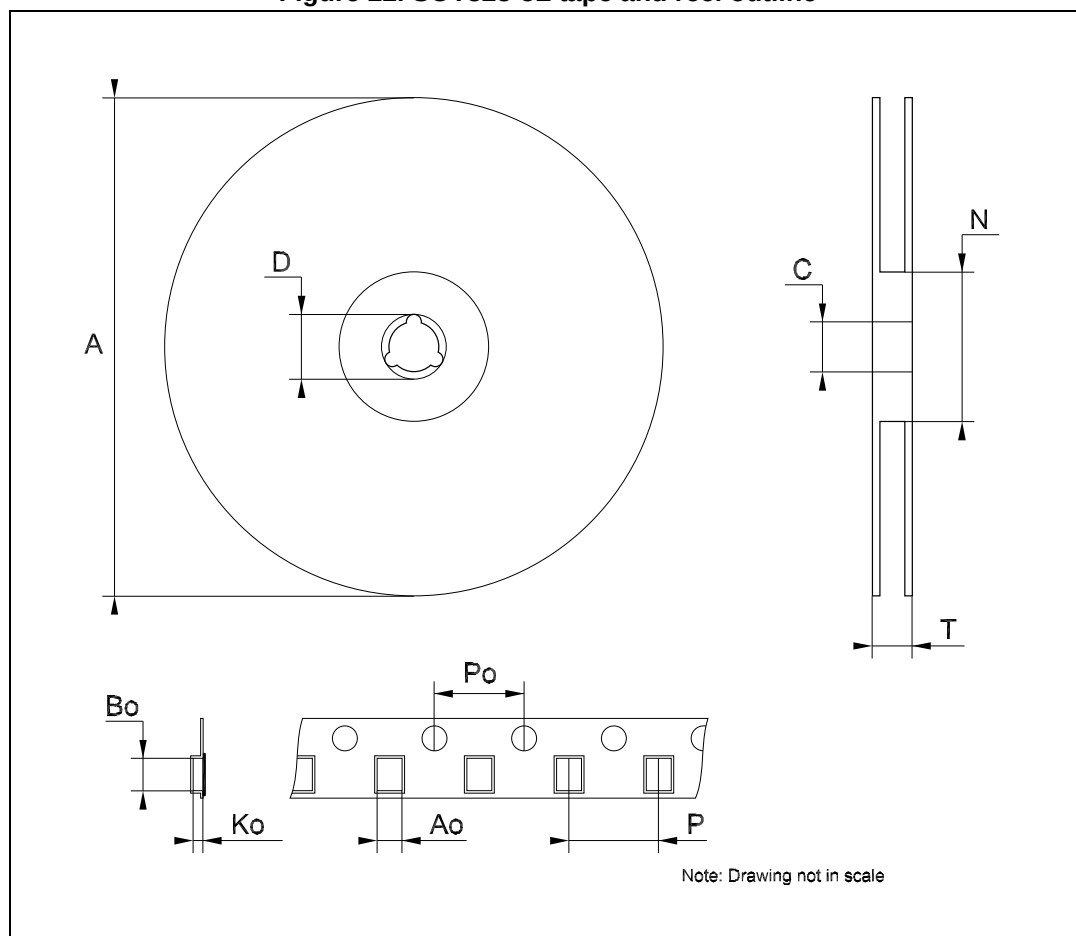


Table 7. SOT323-5L tape and reel mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    | 175  | 180  | 185  |
| C    | 12.8 | 13   | 13.2 |
| D    | 20.2 |      |      |
| N    | 59.5 | 60   | 60.5 |
| T    |      |      | 14.4 |
| Ao   |      | 2.25 |      |
| Bo   |      | 3.17 |      |
| Ko   |      | 1.2  |      |
| Po   | 3.9  | 4.0  | 4.1  |
| P    | 3.9  | 4.0  | 4.2  |



## 8 Revision history

**Table 8. Document revision history**

| Date        | Revision | Changes                                                                                                                                                                                                          |
|-------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10-May-2010 | 1        | Initial release.                                                                                                                                                                                                 |
| 21-Dec-2011 | 2        | Modified: operating input voltage ( $V_{IN}$ ) min. value <i>Table 5 on page 7</i> .<br>Availability LD59015C08R code <i>Table 1 on page 1</i> .                                                                 |
| 06-Jul-2012 | 3        | Updated: <i>Table 1 on page 1</i> .                                                                                                                                                                              |
| 24-Apr-2014 | 4        | Part number LD59015xx changed to LD59015.<br>Updated the description in cover page and <i>Section 7: Package mechanical data</i> .<br>Added <i>Section 8: Packaging mechanical data</i> .<br>Minor text changes. |
| 05-Jul-2017 | 5        | Updated features and <a href="#">Table 1: Device summary</a> .<br>Minor text changes.                                                                                                                            |

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