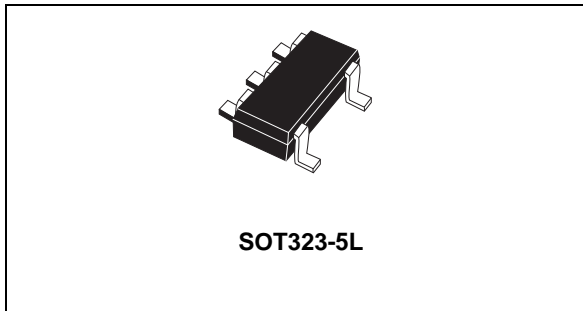


150 mA low noise and high PSRR linear voltage regulator

Datasheet - production data



- 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 μ 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.

Features

- Input voltage from 2.4 to 5.5 V
- Very low quiescent current (31 μ A typ. at no load, 75 μ A typ. at 150 mA load, 1 μ A max. in OFF mode)
- Very low noise (20 μ V_{RMS} 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: 0.8 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

Table 1. Device summary

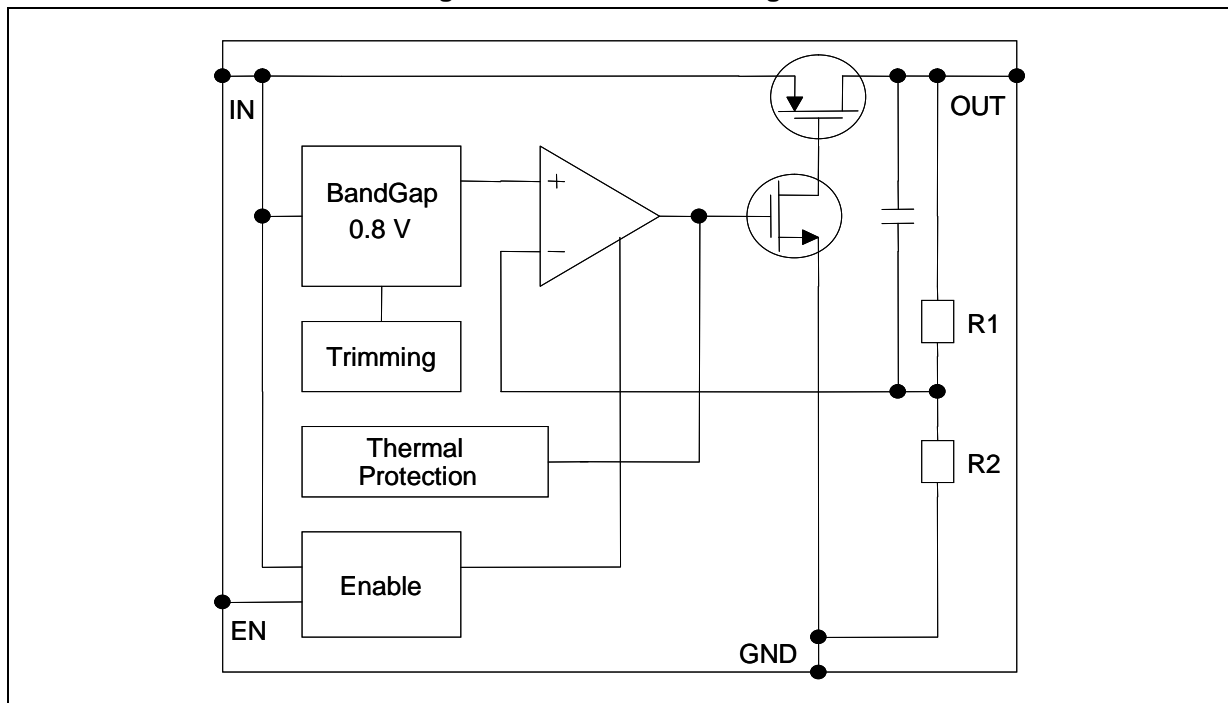
| Order codes | Output voltages |
|-------------|-----------------|
| LD59015C08R | 0.8 V |
| LD59015C12R | 1.2 V |
| LD59015C15R | 1.5 V |
| LD59015C18R | 1.8 V |
| LD59015C25R | 2.5 V |
| LD59015C30R | 3.0 V |
| LD59015C33R | 3.3 V |

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1 Block diagram

Figure 1. LD59015 block diagram



2 Pin configuration

Figure 2. Pin connection (top view)

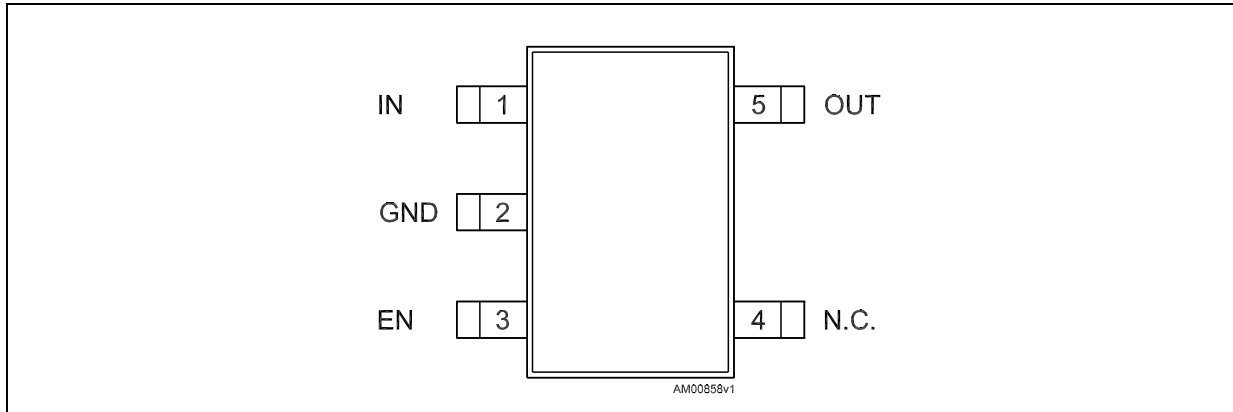
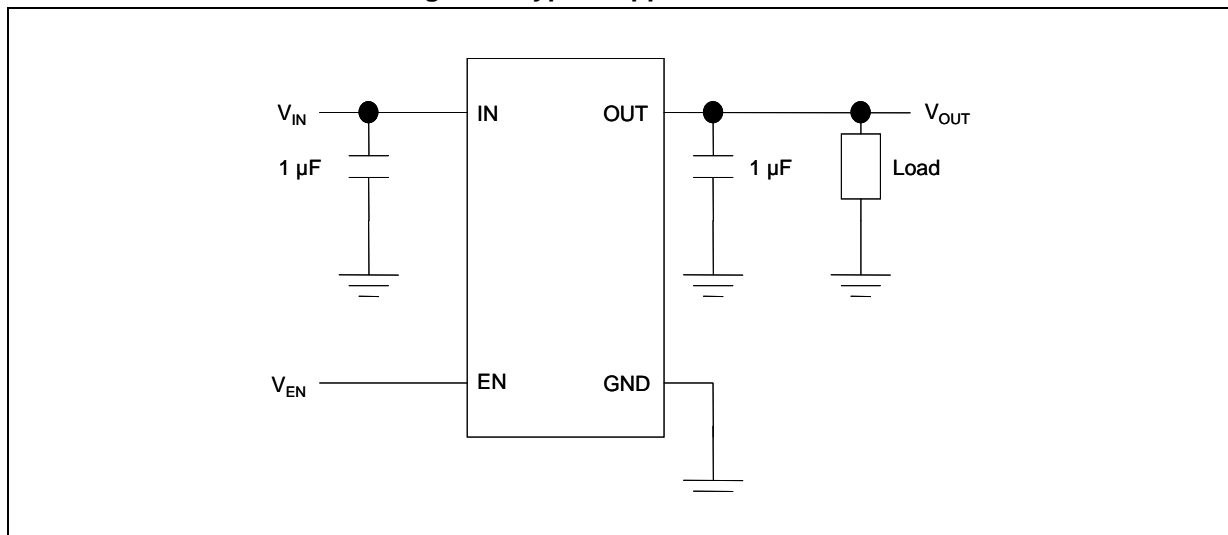


Table 2. Pin description

| Pin n° | Symbol | Function |
|--------|--------|---|
| 1 | IN | Input voltage |
| 2 | GND | Ground |
| 3 | EN | Enable input Set $V_{EN} > 0.9$ to turn on the device 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 | ± 3 | kV |
| | Machine model | ± 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 | $I_{OUT} = 1\text{ mA}$, $-40^\circ\text{C} < T_J < 125^\circ\text{C}$ | -1.8 | | 1.8 | % |
| ΔV_{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 |
| ΔV_{OUT} | Static load regulation | $I_{OUT} = 1\text{ mA}$ to 150 mA | | 0.001 | | %/mA |
| V_{DROP} | Dropout voltage (2) | $I_{OUT} = 150\text{ mA}$, $V_{OUT} > 2.2\text{ V}$ $-40^\circ\text{C} < T_J < 125^\circ\text{C}$ | | 150 | 210 | mV |
| e_N | Output noise voltage | 10Hz to 100kHz, $I_{OUT} = 10\text{ mA}$, $V_{OUT} = 1.5\text{ V}$ | | 20 | | μV_{RMS} /V _{OUT} |
| SVR | Supply voltage rejection $V_{OUT} = 1.5\text{ V}$ | $V_{IN} = V_{OUTNOM} + 1\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.5\text{ V}$, frequency = 1kHz $I_{OUT} = 1\text{ mA}$ | | 76 | | dB |
| | | $V_{IN} = V_{OUTNOM} + 1\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.5\text{ V}$, frequency = 10kHz $I_{OUT} = 1\text{ mA}$ | | 76 | | |
| | | $V_{IN} = V_{OUTNOM} + 1\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.5\text{ V}$, frequency = 100kHz $I_{OUT} = 1\text{ mA}$ | | 54 | | |
| I_Q | Quiescent current | $I_{OUT} = 0\text{ mA}$ | | 31 | | μA |
| | | $I_{OUT} = 0\text{ mA}$, $-40^\circ\text{C} < T_J < 125^\circ\text{C}$ | | | 60 | |
| | | $I_{OUT} = 0$ to 150 mA | | 75 | | |
| | | $I_{OUT} = 0$ to 150 mA $-40^\circ\text{C} < T_J < 125^\circ\text{C}$ | | | 110 | |
| | | V_{IN} input current in OFF mode: $V_{EN} = \text{GND}$ | | 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 V , $-40^\circ\text{C} < T_J < 85^\circ\text{C}$ | | | 0.4 | V |
| | Enable input logic high | $V_{IN} = 2.4\text{ V}$ to 5.5 V , $-40^\circ\text{C} < T_J < 85^\circ\text{C}$ | 0.9 | | | V |
| I_{EN} | Enable pin input current | $V_{SHDN} = 5.5\text{ V}$ | | 0.1 | 100 | nA |
| T_{ON} | Turn-on time (3) | | | 200 | | μs |

Table 5. Electrical characteristics (continued) (1)

| 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 | | 4.7 | μF |

1. For $V_{OUT(NOM)} < 1.3\text{ V}$, $V_{IN} = 2.4\text{ V}$.
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 ($V_{OUT} = 0.8 V$)

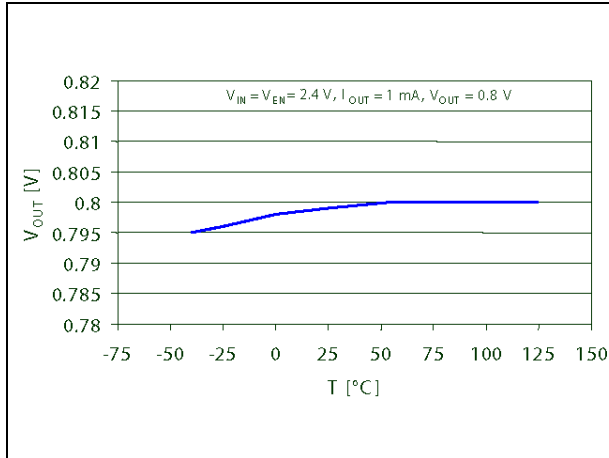


Figure 5. V_{OUT} vs. temperature ($V_{OUT} = 3.3 V$)

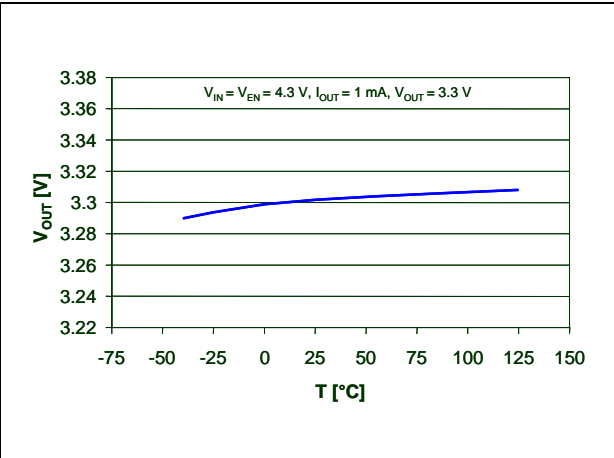


Figure 6. Quiescent current vs. temperature

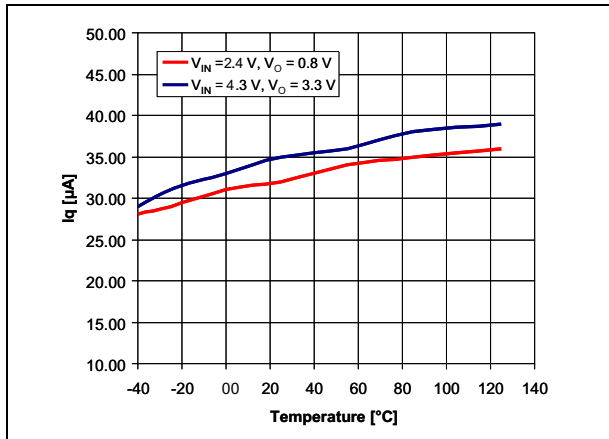


Figure 7. Quiescent current vs. I_{OUT}

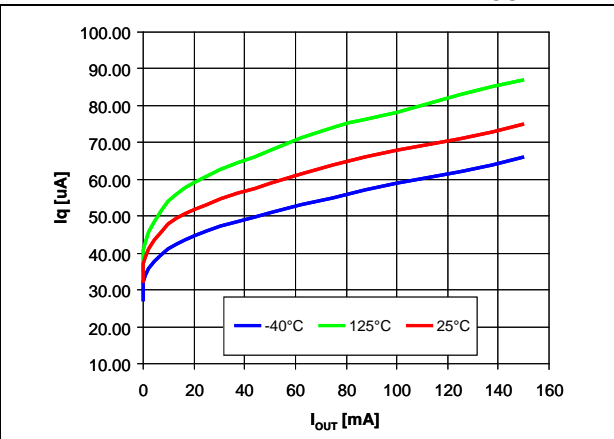


Figure 8. V_{OUT} vs. V_{IN}

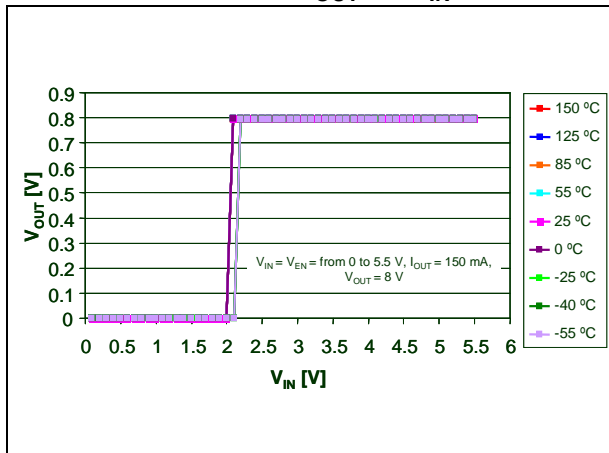


Figure 9. V_{DROP} vs. I_{OUT}

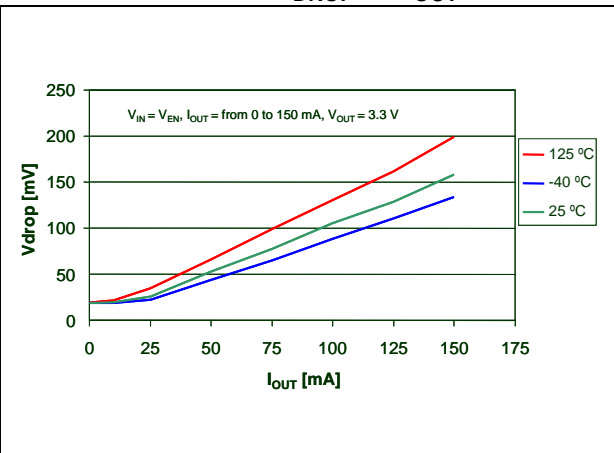


Figure 10. V_{UVLO} vs. temperature

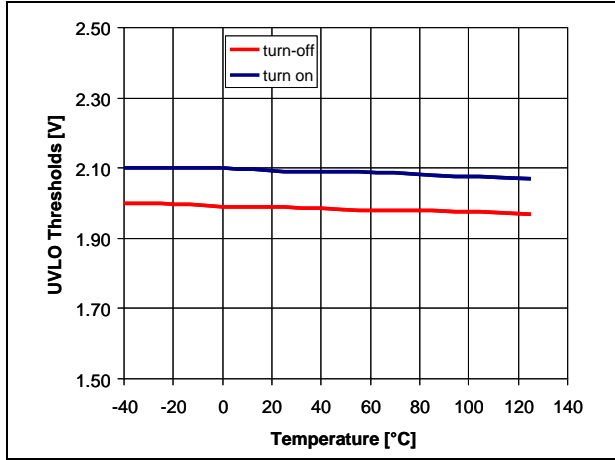


Figure 11. ESR vs. C_{OUT}

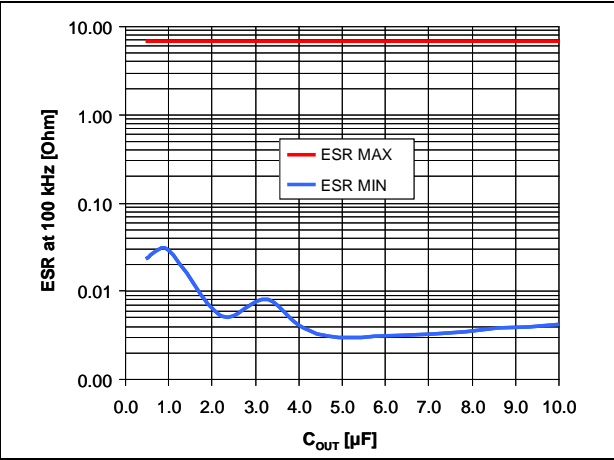


Figure 12. Supply voltage rejection vs. frequency

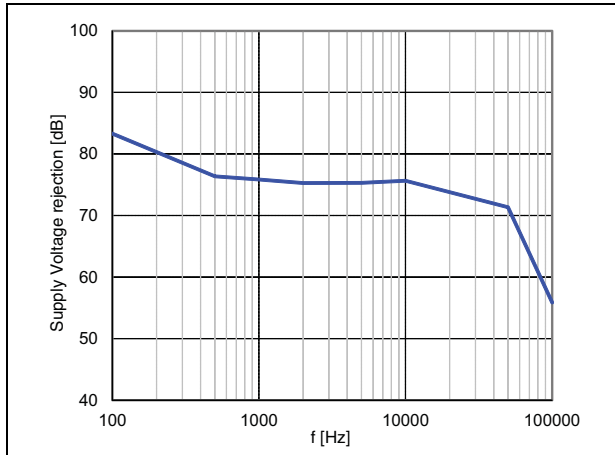


Figure 13. Supply voltage rejection vs. I_{OUT}

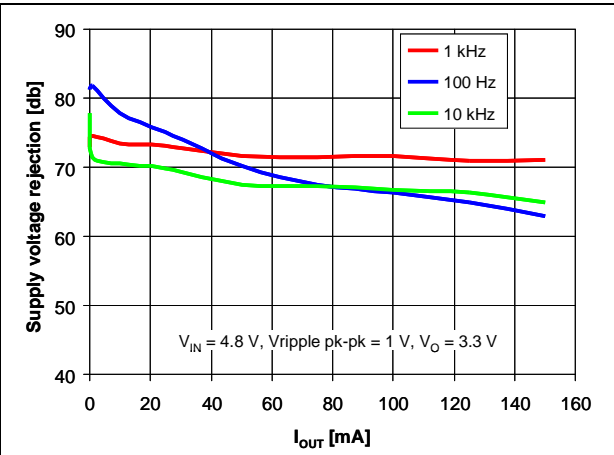


Figure 14. I_{SC} vs. V_{DROP}

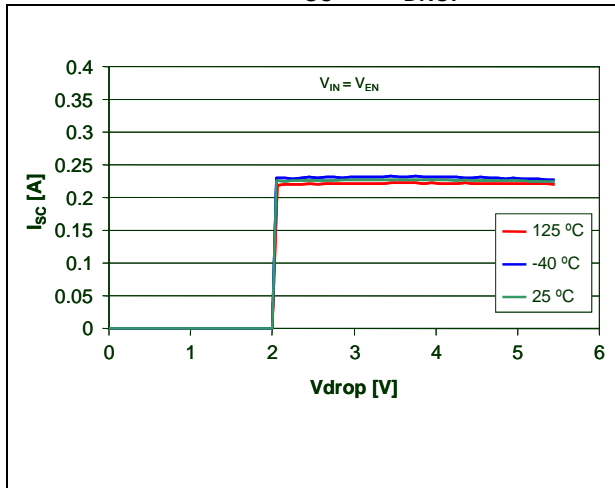


Figure 15. Line transient ($V_{OUT} = 0.8$ V)

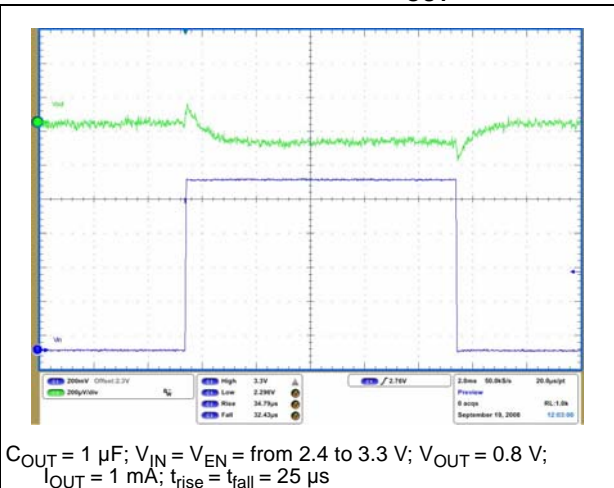
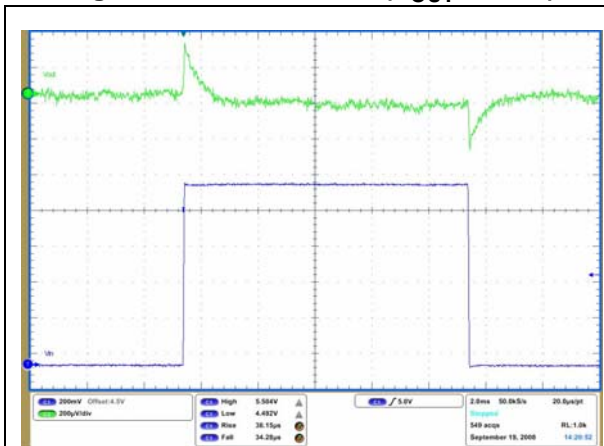
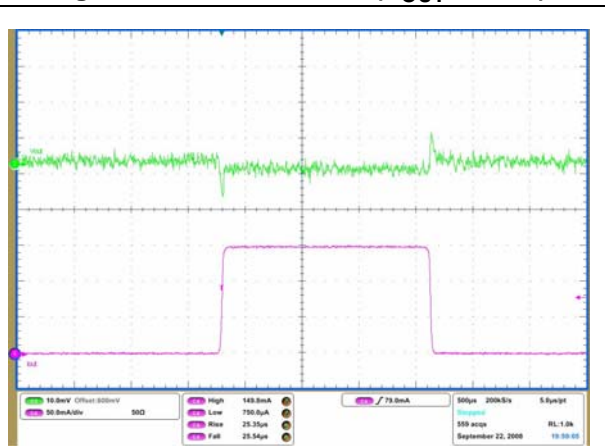


Figure 16. Line transient ($V_{OUT} = 3.3\text{ V}$)



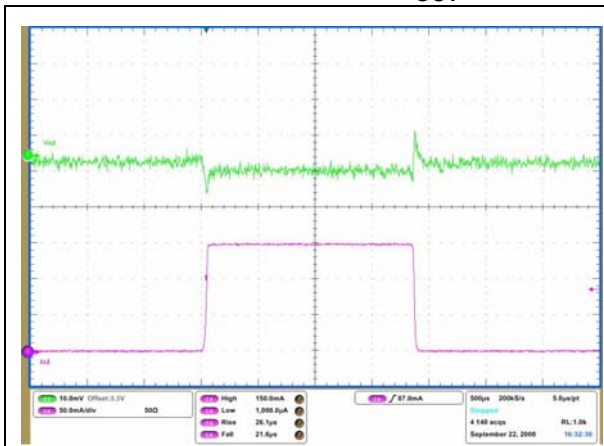
$C_{OUT} = 1\ \mu\text{F}$; $V_{IN} = V_{EN} =$ from 4.5 to 5.5 V; $V_{OUT} = 3.3\text{ V}$;
 $I_{OUT} = 1\text{ mA}$; $t_{rise} = t_{fall} = 25\ \mu\text{s}$

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



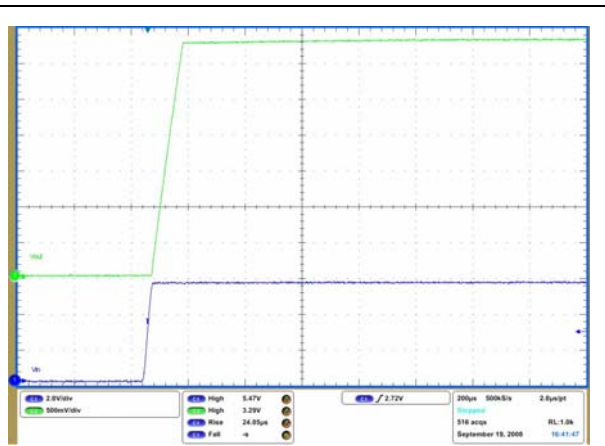
$C_{IN} = C_{OUT} = 1\ \mu\text{F}$; $V_{IN} = V_{EN} = 2.4\text{ V}$; $V_{OUT} = 0.8\text{ V}$;
 I_{OUT} from 0.1 to 150 mA; $t_{rise} = t_{fall} = 25\ \mu\text{s}$

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



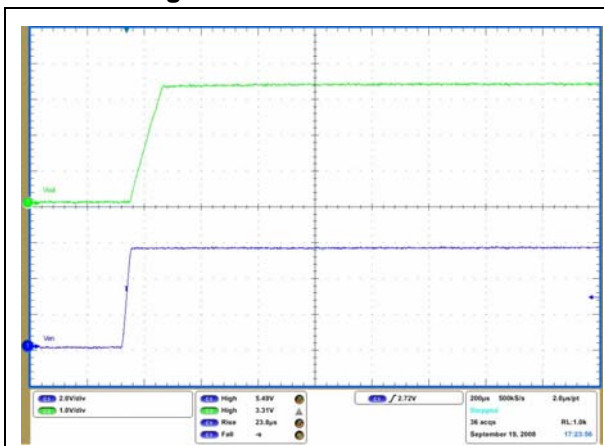
$C_{IN} = C_{OUT} = 1\ \mu\text{F}$; $V_{IN} = V_{EN} = 4.3\text{ V}$; $V_{OUT} = 3.3\text{ V}$;
 I_{OUT} from 0.1 to 150 mA; $t_{rise} = t_{fall} = 25\ \mu\text{s}$

Figure 19. Start-up transient



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

Figure 20. Enable transient



$C_{IN} = C_{OUT} = 1\ \mu\text{F}$; $V_{IN} = 4.3\text{ V}$; $V_{EN} =$ from 0 to 5.5 V;
 $V_{OUT} = 3.3\text{ V}$; $I_{OUT} = 1\text{ mA}$; $t_{rise} = 25\ \mu\text{s}$

7 Package mechanical data

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Figure 21. SOT323-5L drawings

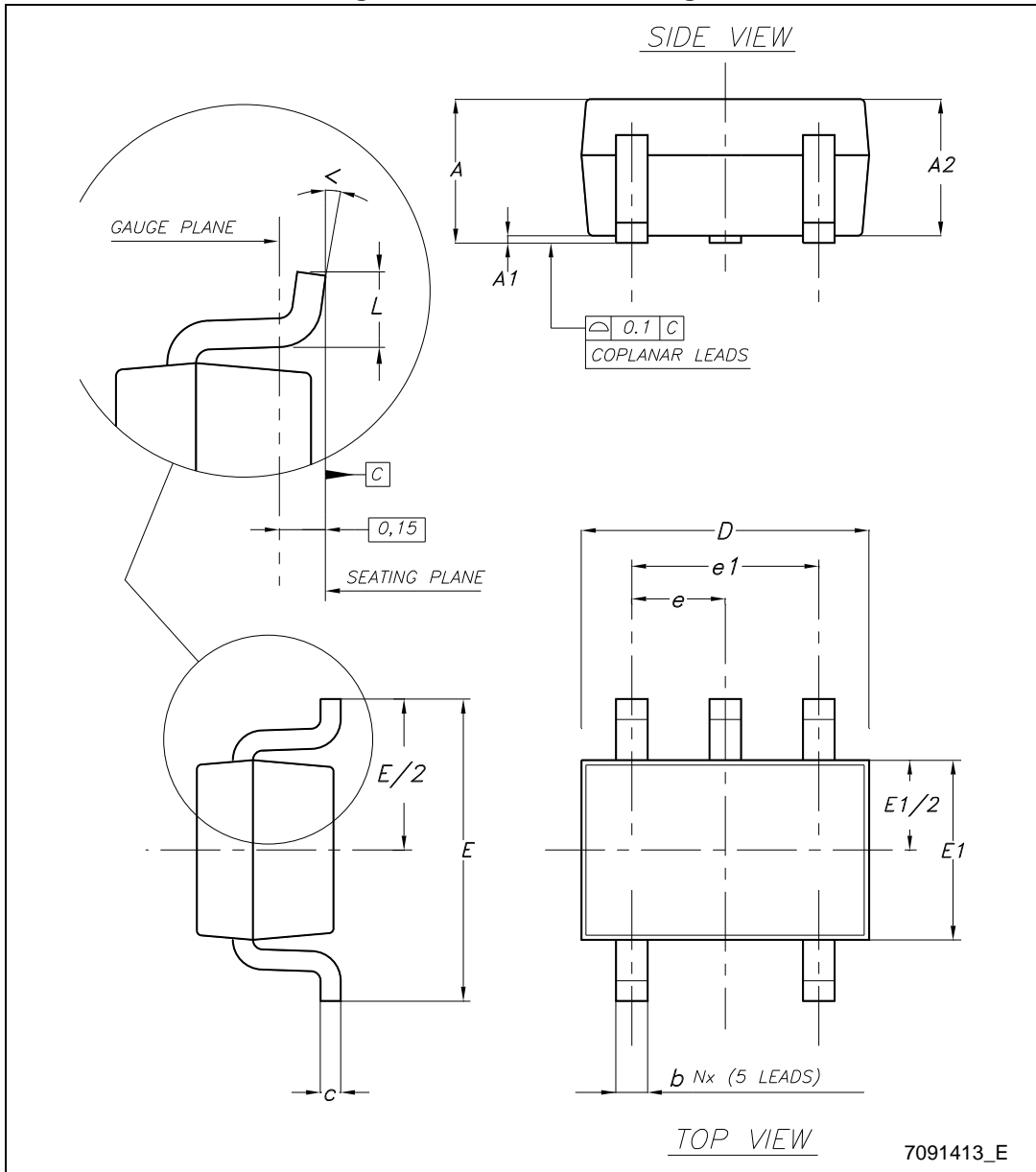


Table 6. SOT323-5L mechanical data

| 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° |

8 Packaging mechanical data

Figure 22. SOT323-5L tape and reel drawings

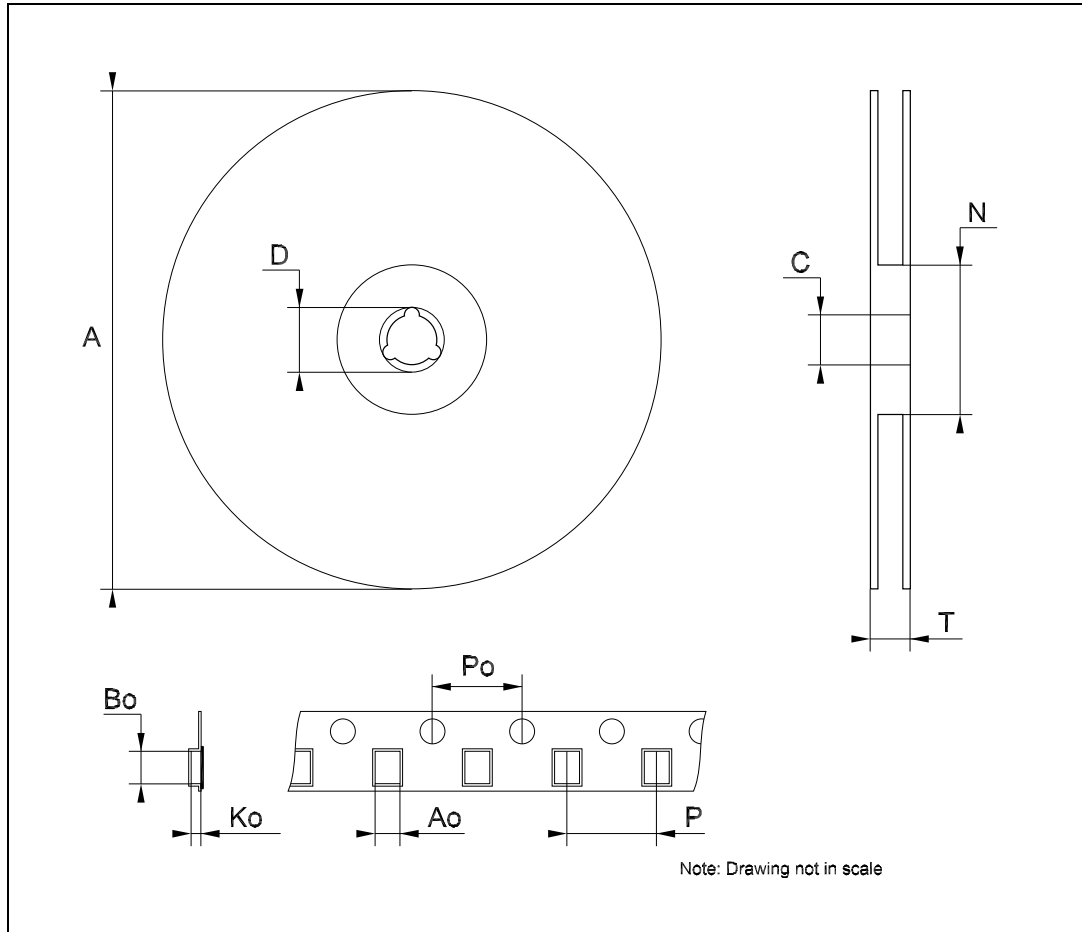


Table 7. SOT323-5L tape and reel mechanical data

| 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 |

9 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 Table 5 on page 7 . Availability LD59015C08R code Table 1 on page 1 . |
| 06-Jul-2012 | 3 | Updated: Table 1 on page 1 . |
| 24-Apr-2014 | 4 | Part number LD59015xx changed to LD59015. Updated the description in cover page and Section 7: Package mechanical data . Added Section 8: Packaging mechanical data . Minor text changes. |

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