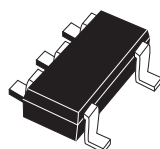


150 mA low noise high PSRR linear voltage regulator

Datasheet - production data



SOT323-5L

Features

- Input voltage from 2.4 to 5.5 V
- Very low quiescent current (31 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: 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 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.

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

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7 **Package information** **13**

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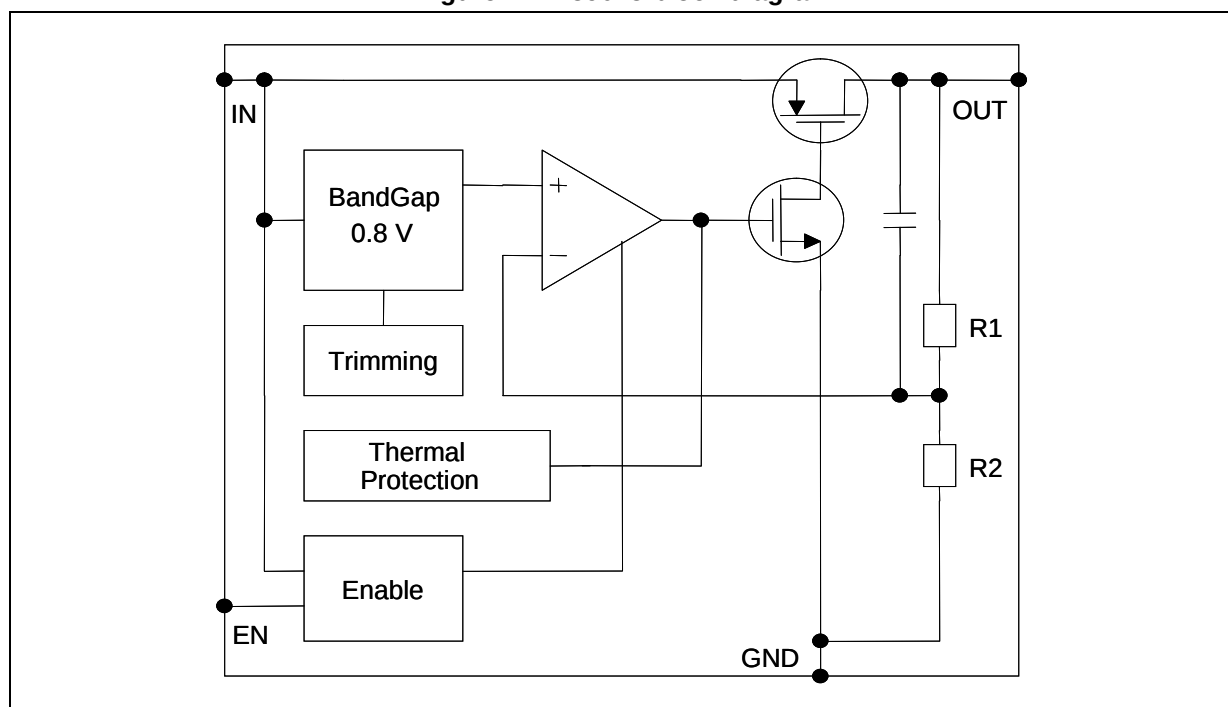
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8 **Revision history** **17**



1 Block diagram

Figure 1. LD59015 block diagram



2 Pin configuration

Figure 2. Pin connection (top view)

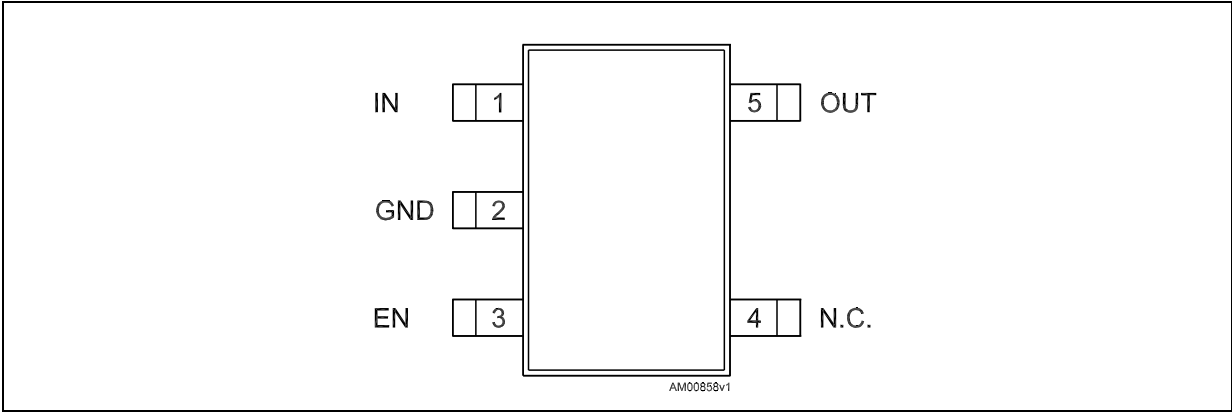
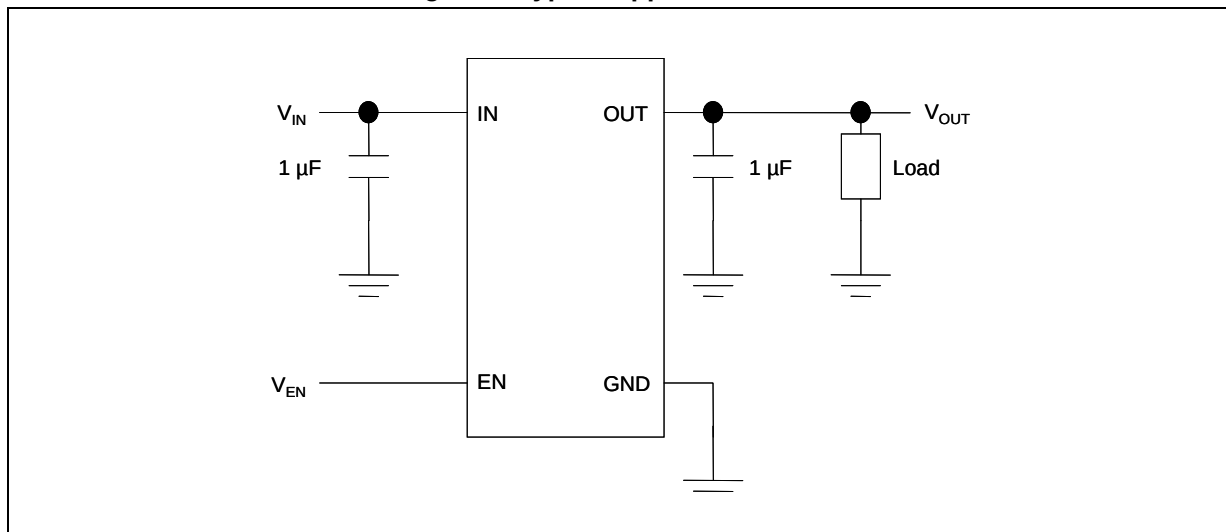


Table 2. Pin description

Pin	Symbol	Function
1	IN	Input voltage
2	GND	Ground
3	EN	Enable input 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	$I_{OUT} = 1\text{ mA}$, $-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$	-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)	$I_{OUT} = 150\text{ mA}$, $V_{OUT} > 2.2\text{ V}$ $-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$		150	210	mV
e_N	Output noise voltage	10 Hz to 100 kHz, $I_{OUT} = 10\text{ mA}$, $V_{OUT} = 1.5\text{ V}$		20		μV_{RMS} N_{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 = 1 kHz $I_{OUT} = 1\text{ mA}$		76		dB
		$V_{IN} = V_{OUTNOM} + 1\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.5\text{ V}$, frequency = 10 kHz $I_{OUT} = 1\text{ mA}$		76		
		$V_{IN} = V_{OUTNOM} + 1\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.5\text{ V}$, frequency = 100 kHz $I_{OUT} = 1\text{ mA}$		54		
I_Q	Quiescent current	$I_{OUT} = 0\text{ mA}$		31		μA
		$I_{OUT} = 0\text{ mA}$, $-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$			60	
		$I_{OUT} = 0$ to 150 mA		75		
		$I_{OUT} = 0$ to 150 mA $-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$			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 , $-40\text{ }^{\circ}\text{C} < T_J < 85\text{ }^{\circ}\text{C}$			0.4	V
	Enable input logic high	$V_{IN} = 2.4\text{ V}$ to 5.5 V , $-40\text{ }^{\circ}\text{C} < T_J < 85\text{ }^{\circ}\text{C}$	0.9			V

Table 5. Electrical characteristics (continued)⁽¹⁾

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 ⁽³⁾			200		μs
T_{SHDN}	Thermal shutdown			160		°C
	Hysteresis			20		
C_{OUT}	Output capacitor	Capacitance (see Section 6)	1		4.7	μF

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

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 ($V_{OUT} = 0.8 \text{ V}$)

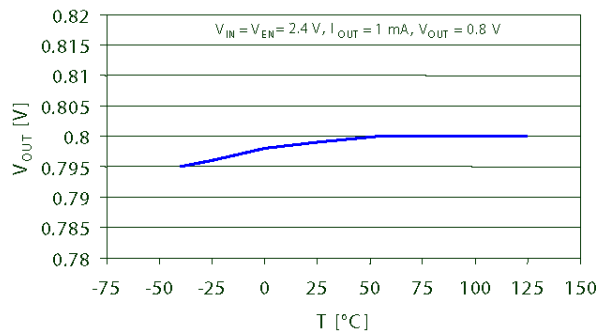


Figure 5. V_{OUT} vs. temperature ($V_{OUT} = 3.3 \text{ V}$)

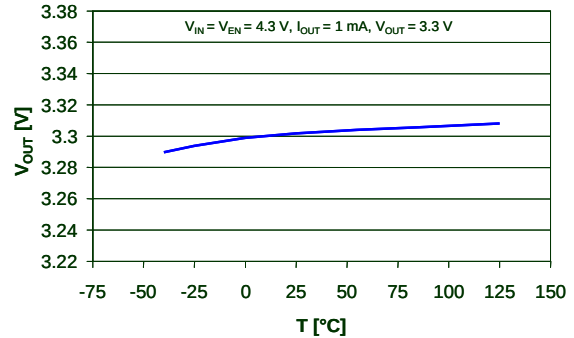


Figure 6. Quiescent current vs. temperature

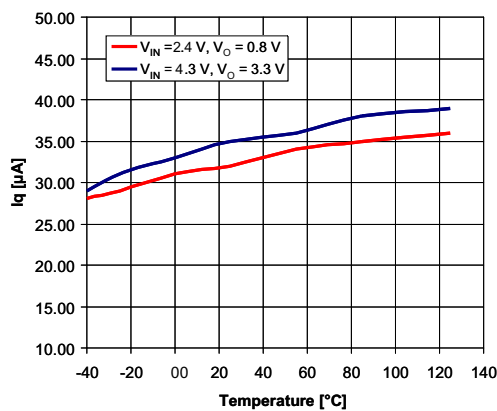


Figure 7. Quiescent current vs. I_{OUT}

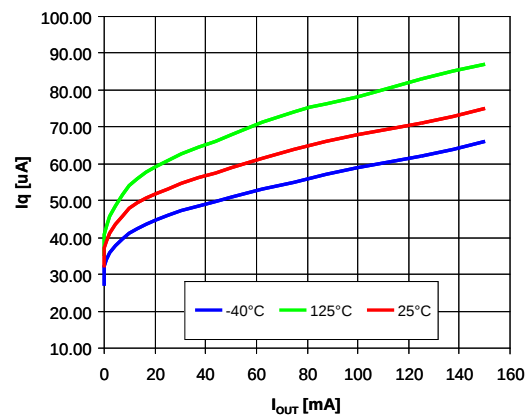


Figure 8. V_{OUT} vs. V_{IN}

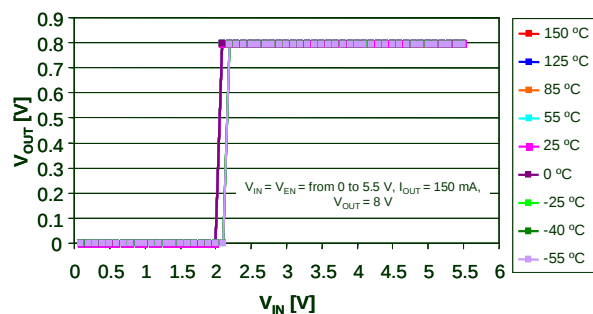


Figure 9. V_{DROP} vs. I_{OUT}

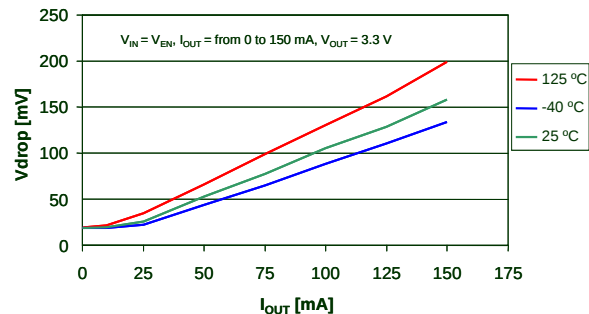


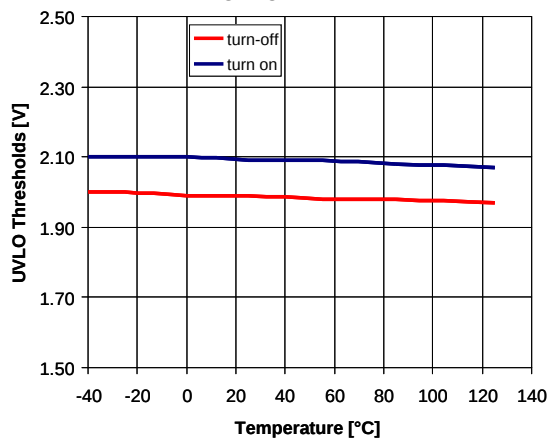
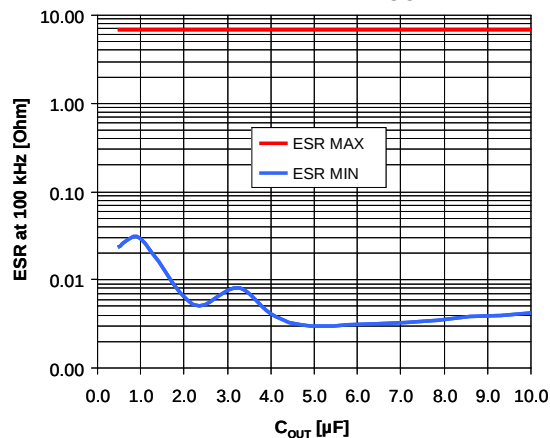
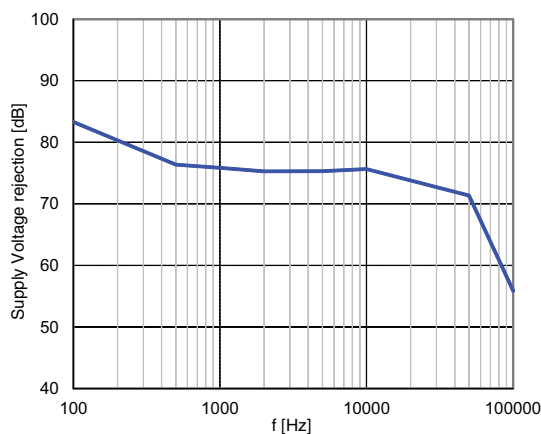
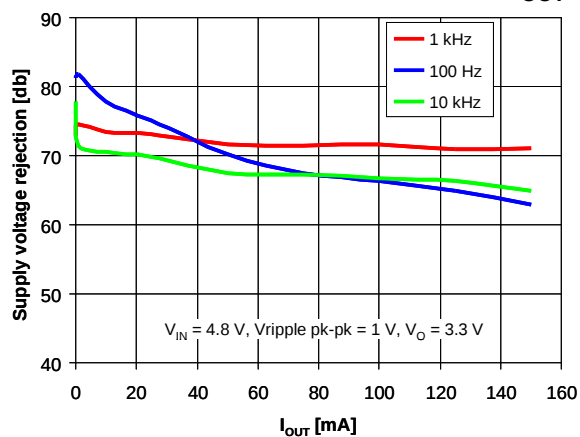
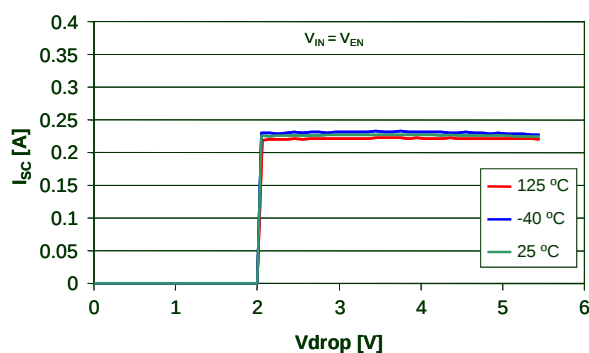
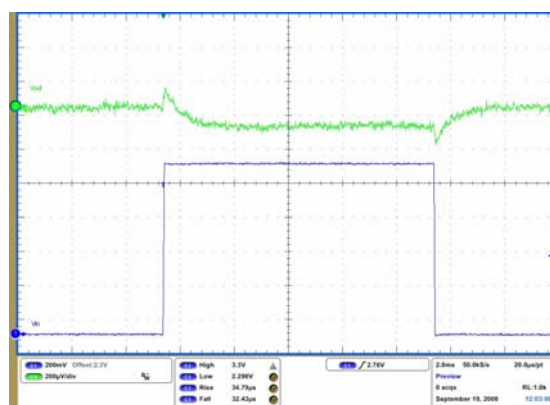
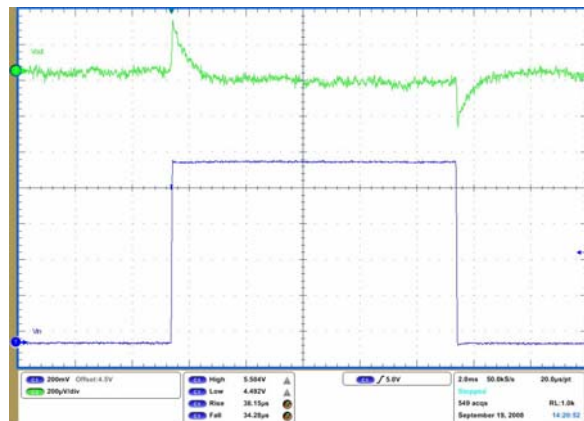
Figure 10. V_{UVLO} vs. temperatureFigure 11. ESR vs. C_{OUT} 

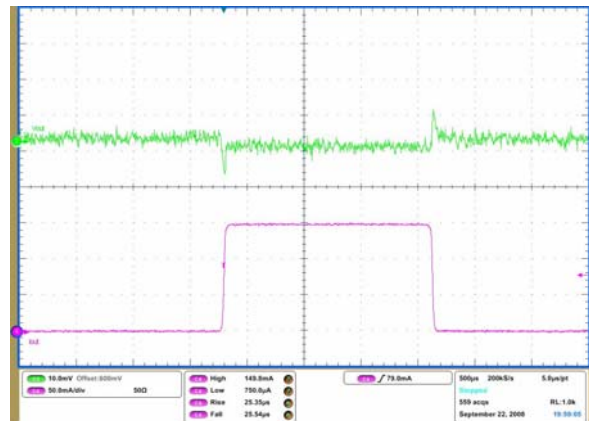
Figure 12. Supply voltage rejection vs. frequency

Figure 13. Supply voltage rejection vs. I_{OUT} Figure 14. I_{SC} vs. V_{DROP} Figure 15. Line transient ($V_{OUT} = 0.8$ V)

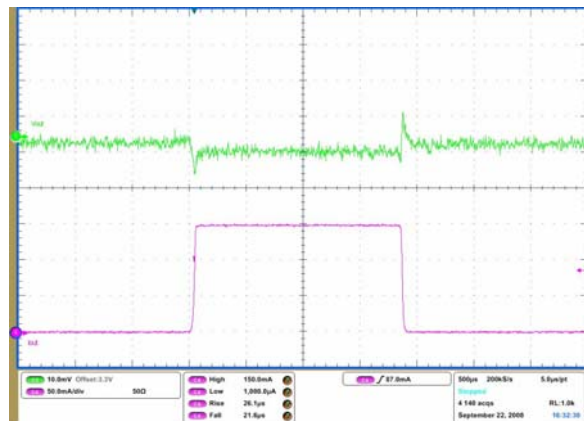
$C_{OUT} = 1$ μF; $V_{IN} = V_{EN}$ = from 2.4 to 3.3 V;
 $V_{OUT} = 0.8$ V; $I_{OUT} = 1$ mA; $t_{rise} = t_{fall} = 25$ μs

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

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

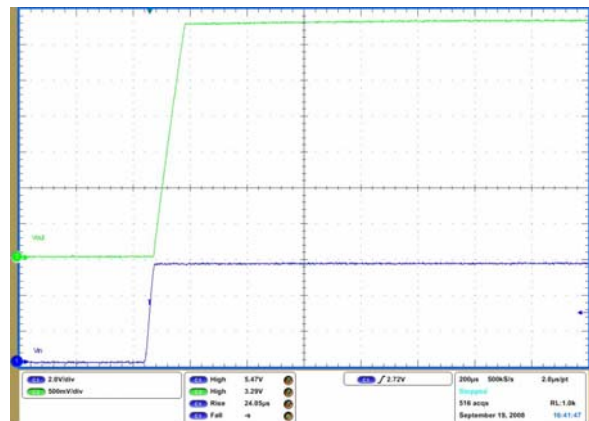
Figure 17. Load transient ($V_{OUT} = 0.8\text{ V}$)

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

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

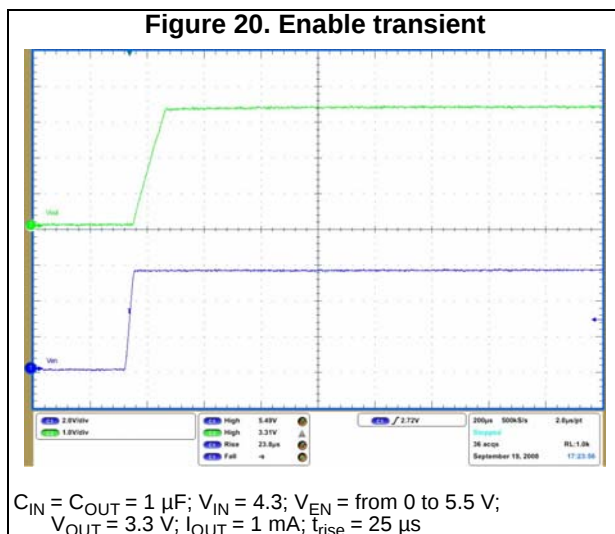
$C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$; $V_{IN} = V_{EN} = 4.3\text{ V}$; $V_{OUT} = 3.3\text{ V}$; I_{OUT} from 0.1 to 150 mA ; $t_{rise} = t_{fall} = 25\text{ }\mu\text{s}$

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. ECOPACK® is an ST trademark.

7.1 SOT323-5L package information

Figure 21. SOT323-5L package outline

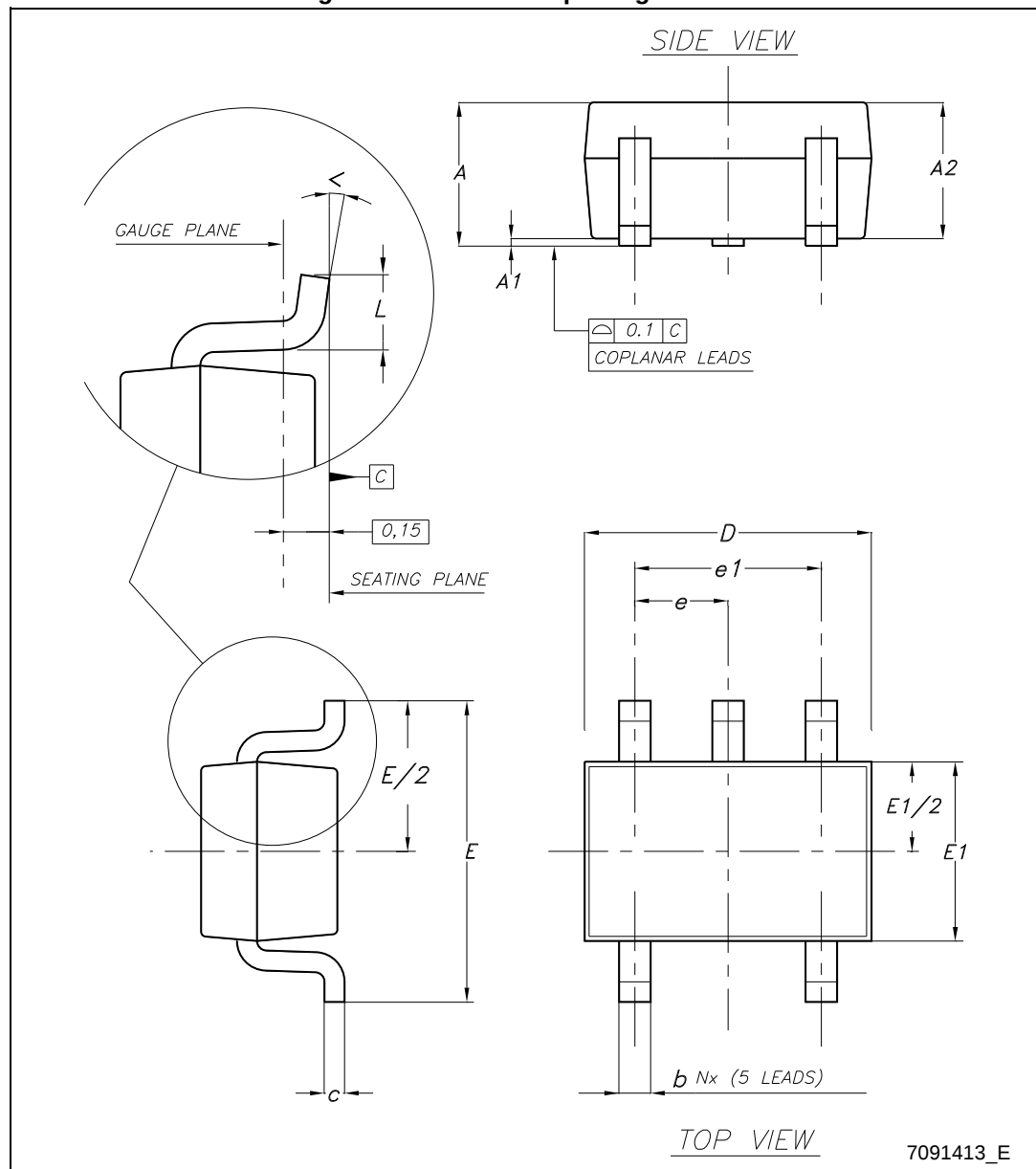


Table 6. SOT323-5L package mechanical data

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

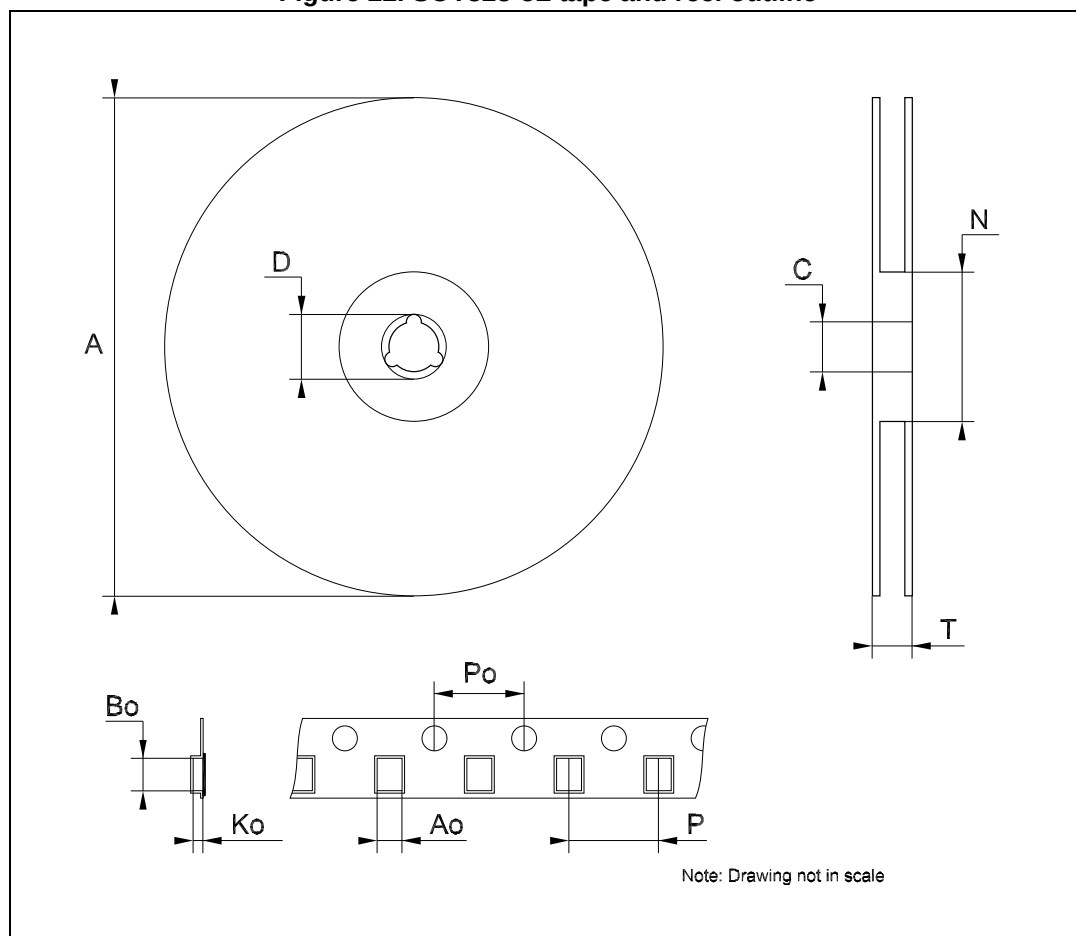


Table 7. SOT323-5L tape and reel mechanical data

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> . 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. Updated the description in cover page and <i>Section 7: Package mechanical data</i> . Added <i>Section 8: Packaging mechanical data</i> . Minor text changes.
05-Jul-2017	5	Updated features and Table 1: Device summary . Minor text changes.

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