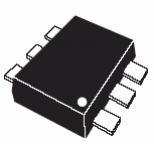
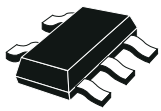
LD39015

150 mA low quiescent current and low noise voltage regulator

Datasheet - production data



SOT666



SOT23-5L

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_{OUT} = 0.8 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 3.3 V with 100 mV step
- Logic-controlled electronic shutdown
- Compatible with ceramic capacitors C_O = 1 µF
- Internal current and thermal limit
- Available in SOT666 and SOT23-5L packages
- Temperature range: -40 °C to 125 °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 µA. 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.

Table 1. Device summary

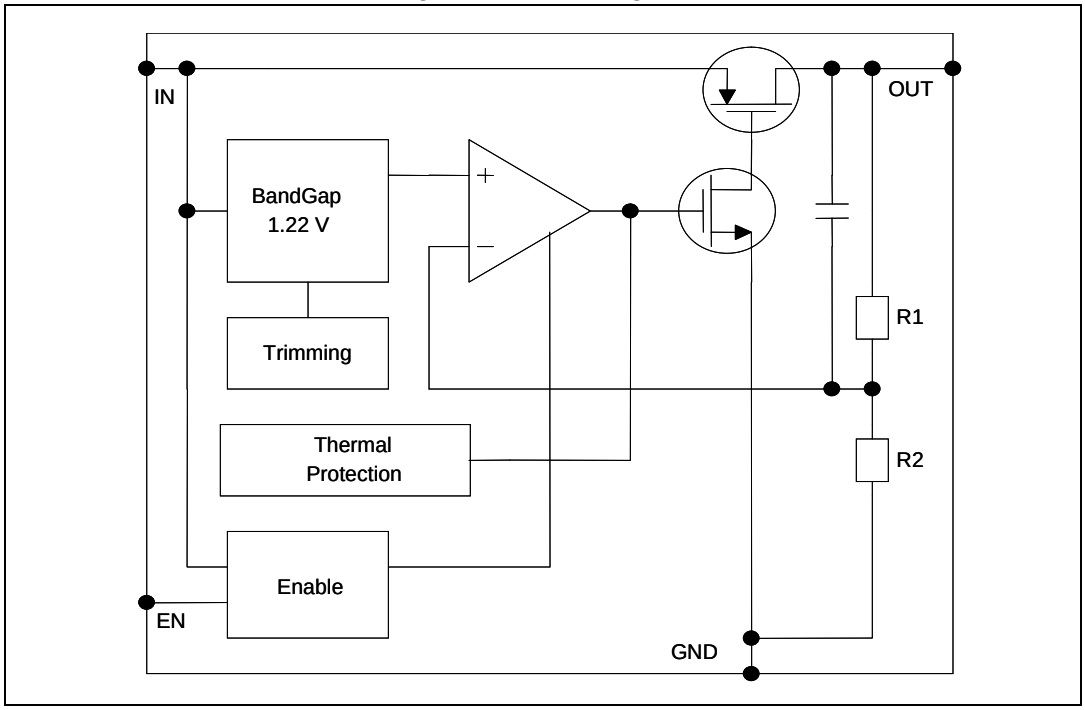
Order codes		Output voltages
SOT666	SOT23-5L	
LD39015XG08R	LD39015M08R	0.8 V
LD39015XG10R	LD39015M10R	1.0 V
LD39015XG12R(1)	LD39015M12R	1.2 V
	LD39015M125R	1.25 V
LD39015XG15R	LD39015M15R	1.5 V
LD39015XG18R(1)	LD39015M18R	1.8 V
LD39015XG25R(1)	LD39015M25R	2.5 V
LD39015XG33R(1)	LD39015M33R	3.3 V

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

Contents

1 Diagram

Figure 1. Block diagram



2 Pin configuration

Figure 2. Pin connection (top view)

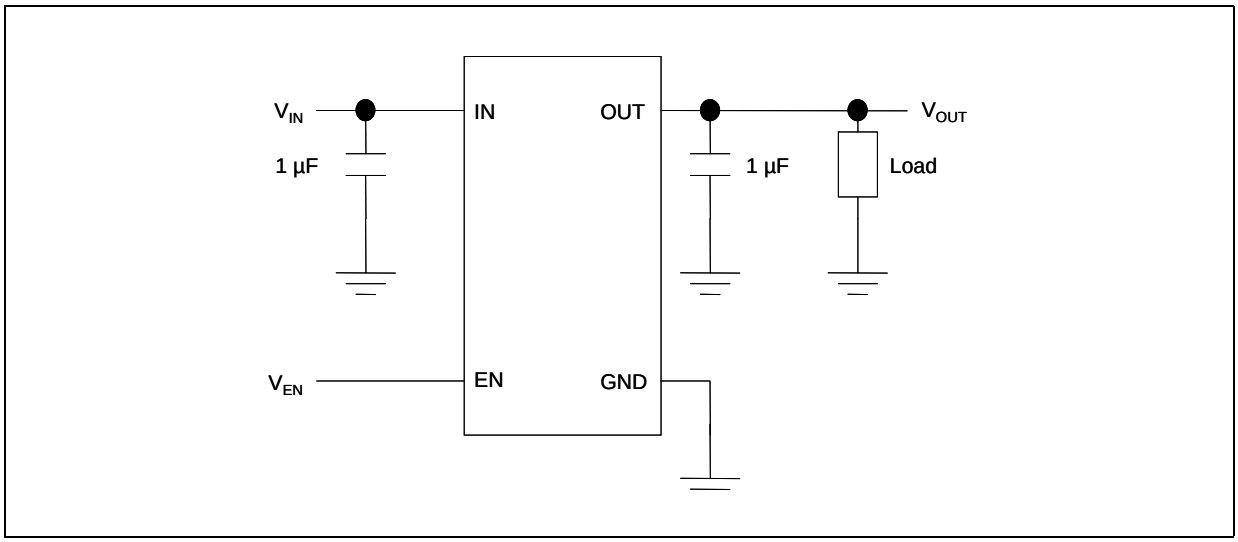
SOT666 SOT23-5L

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 °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 (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 V, I_{OUT} = 1 mA T_J = 25 °C	-2.0		2.0	%
		V_{OUT} > 1.5 V, I_{OUT} = 1 mA -40 °C < T_J < 125 °C	-3.0		3.0	
		V_{OUT} ≤ 1.5 V, I_{OUT} = 1 mA		±10		mV
		V_{OUT} ≤ 1.5 V, I_{OUT} = 1 mA -40 °C < T_J < 125 °C		±30		
ΔV_{OUT}	Static line regulation	V_{OUT} +1 V ≤ V_{IN} ≤ 5.5 V I_{OUT} = 1 mA		0.01		%/V
ΔV_{OUT}	Transient line regulation (2)	ΔV_{IN} = + 500 mV, I_{OUT} = 1 mA T_R = T_F = 5 µs		10		mVpp
ΔV_{OUT}	Static load regulation	I_{OUT} = 1 mA to 150 mA		0.002		%/mA
ΔV_{OUT}	Transient load regulation (2)	I_{OUT} = 1 mA to 150 mA T_R = T_F = 5 µs		40		mVpp
V_{DROP}	Dropout voltage (3)	I_{OUT} = 100 mA, V_{OUT} > 1.5 V -40 °C < T_J < 125 °C		80	100	mV
e_N	Output noise voltage	1.1 kHz to 100 kHz, I_{OUT} = 10 mA V_{OUT} = 0.8 V		29		μV_{RMS}
SVR	Supply voltage rejection V_{OUT} = 1.5 V	V_{IN} = V_{OUTNOM} + 0.5 V +/-V_{RIPPLE} V_{RIPPLE} = 0.1 V, freq. = 1 kHz I_{OUT} = 10 mA		65		dB
		V_{IN} = V_{OUTNOM} + 0.5 V +/-V_{RIPPLE} V_{RIPPLE} = 0.1 V, freq.=10 kHz I_{OUT} = 10 mA		62		
I_Q	Quiescent current	I_{OUT} = 0 mA		18		µA
		I_{OUT} = 0 mA, -40 °C < T_J < 125 °C			50	
		I_{OUT} = 0 to 150 mA		38		
		I_{OUT} = 0 to 150 mA -40 °C < T_J< 125 °C			70	
		V_{IN} input current in OFF mode: V_{EN} = 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 V to 5.5 V -40 °C < T_J < 125 °C			0.4	V
	Enable input logic high	V_{IN} = 1.5 V to 5.5 V -40 °C < T_J < 125 °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		°C
	Hysteresis			20		
C_{OUT}	Output capacitor	Capacitance (see typical performance characteristics for stability)	1		22	µF

1. For $V_{OUT(NOM)}$ < 1.2 V, V_{IN} = 1.5 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

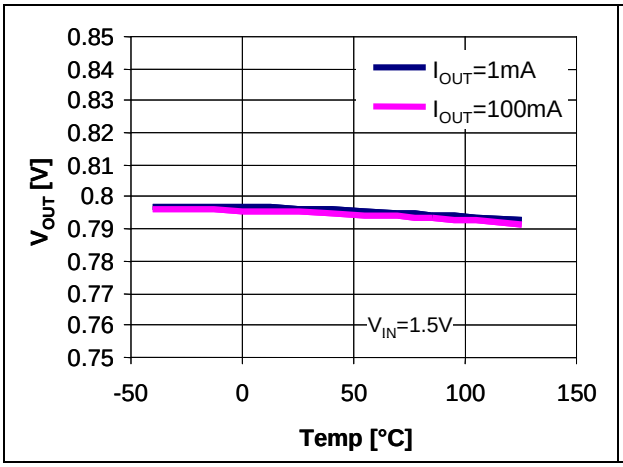


Figure 5. Output voltage vs. input voltage

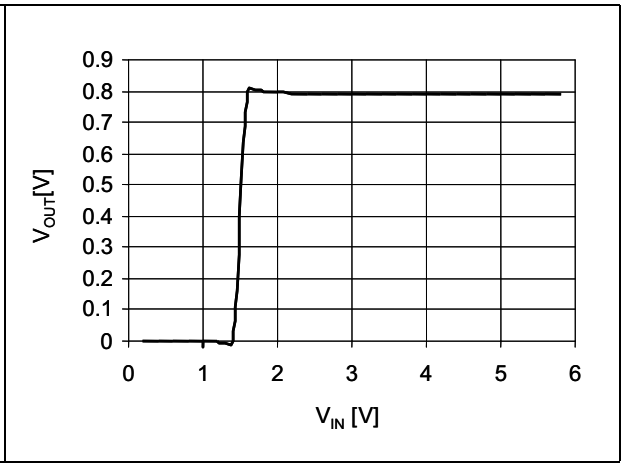


Figure 6. Dropout voltage vs. output current

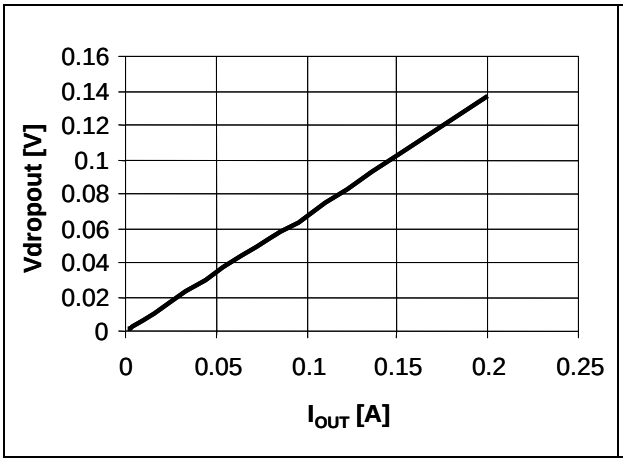


Figure 7. C_{OUT} stability region

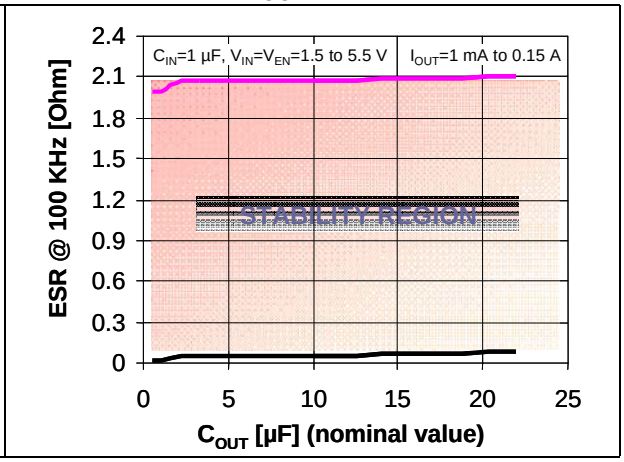


Figure 8. Supply voltage rejection vs. frequency

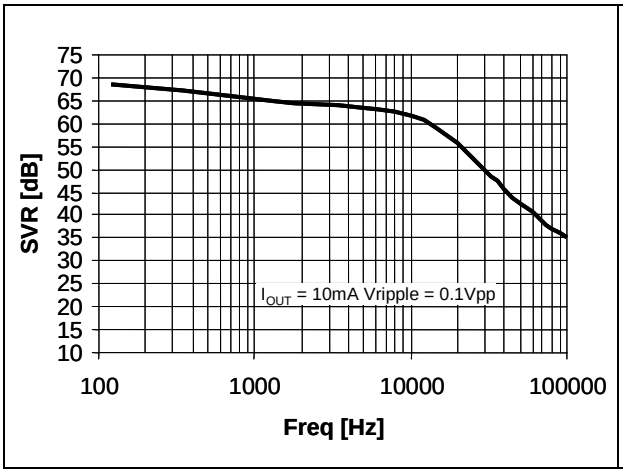


Figure 9. Output noise voltage vs. frequency

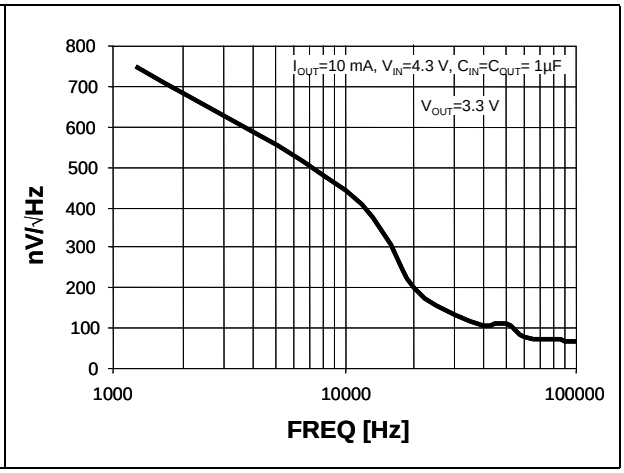


Figure 10. Quiescent current vs. input voltage

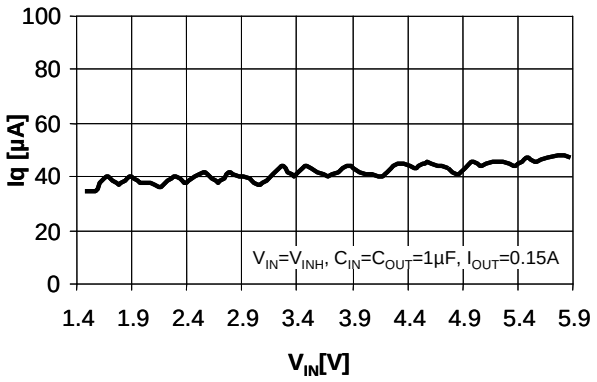
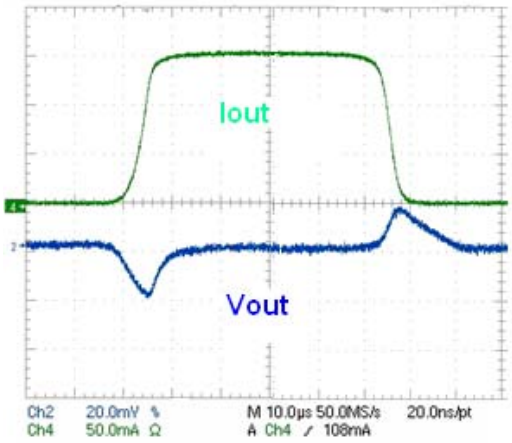
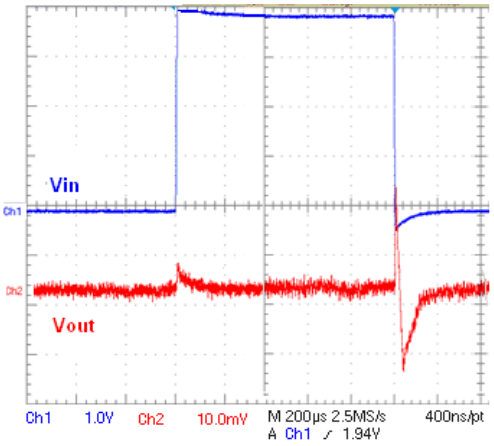


Figure 11. Load transient



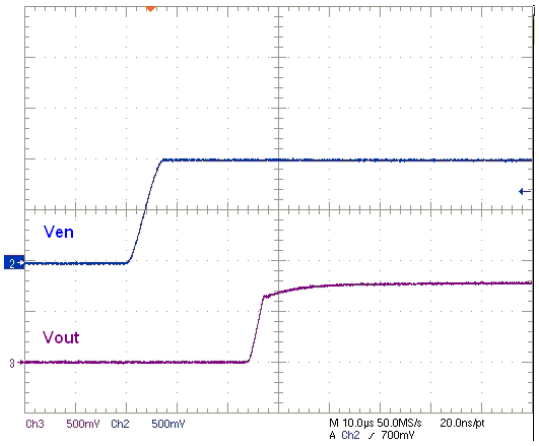
V_{EN} = V_{IN} = 1.5V, I_{OUT} = 1mA to 0.15A, C_{IN} = C_{OUT} = 1µF, t_r = t_f = 5µs

Figure 12. Line transient



V_{IN} = V_{EN} = 1.5 to 5.5V, I_{OUT} = 1mA, C_{OUT} = 1µF, t_r = t_f = 5µs

Figure 13. Enable transient



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

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

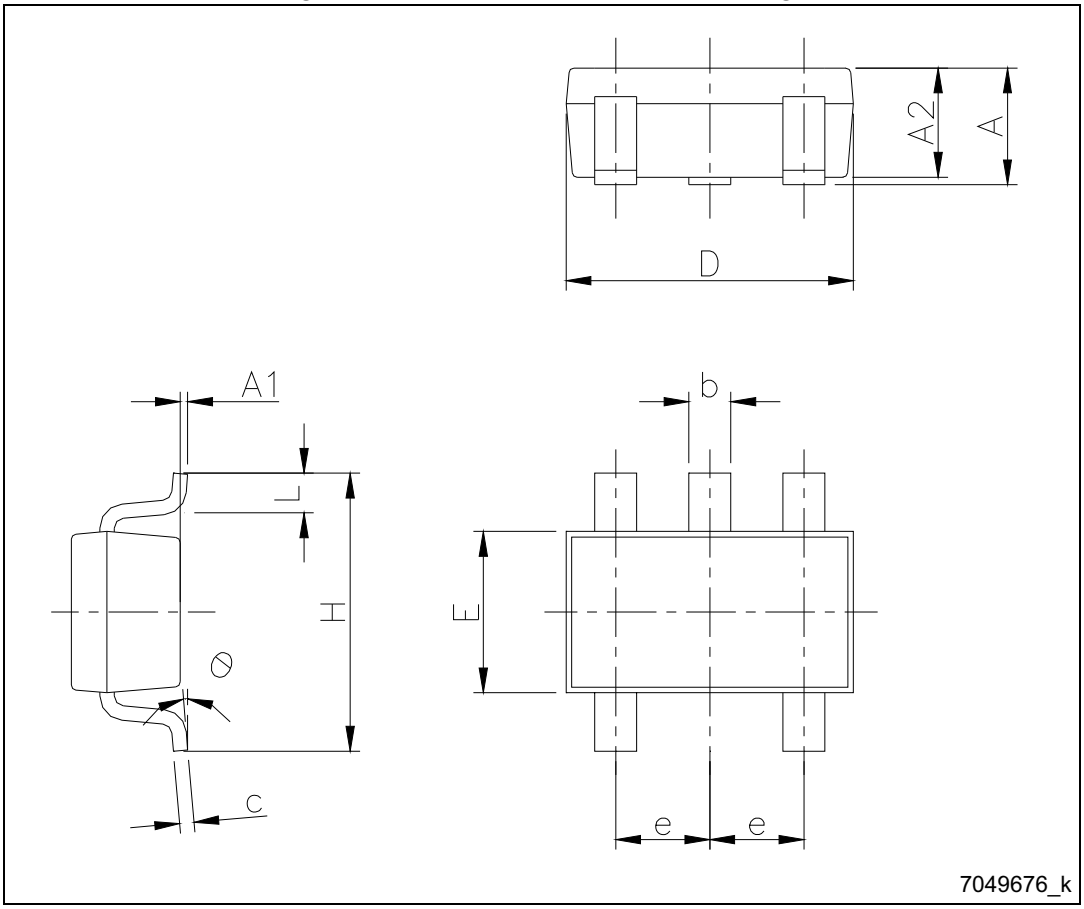


Table 6. SOT23-5L mechanical data

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)

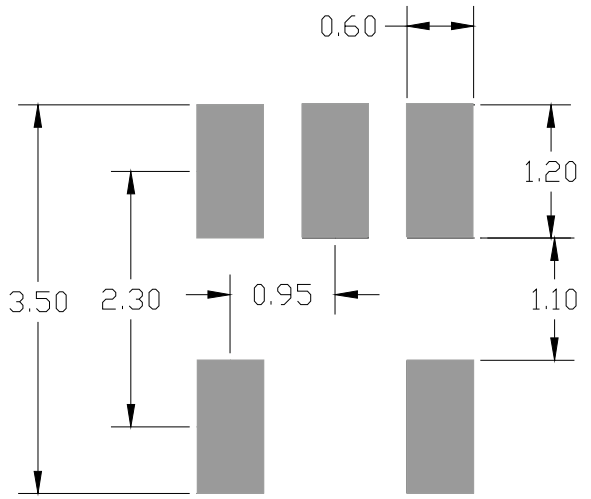


Figure 16. SOT666 mechanical drawings

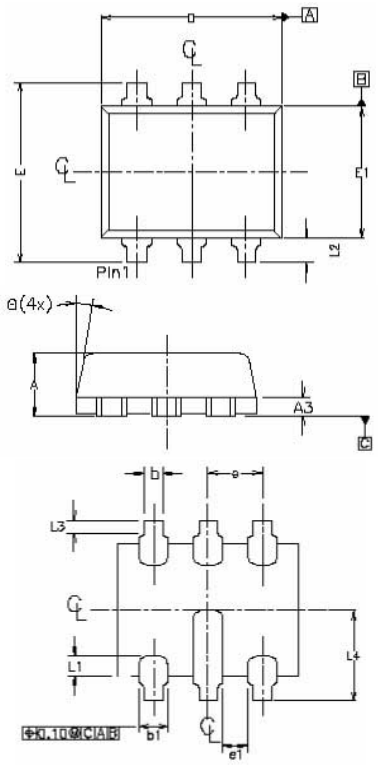


Table 7. SOT666 mechanical data

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

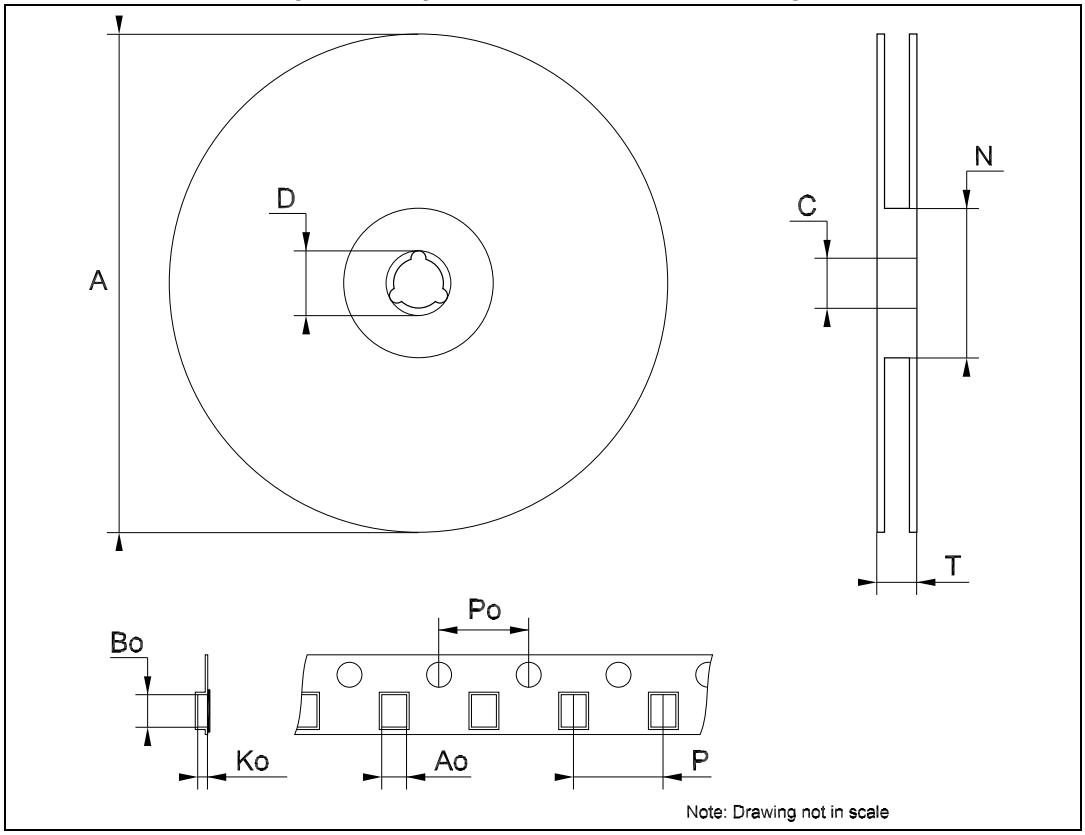


Table 8. Tape and reel SOT23-5L mechanical data

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.

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