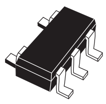
STLQ015

150 mA, ultra low quiescent current linear voltage regulator

Datasheet - production data



SOT23-5L

Features

- Input voltage from 1.5 to 5.5 V
- Very low quiescent current:
  - 1.0 µA (typ.) at no load
  - 1.4 µA (typ.) at 150 mA load
  - 1 nA (typ.) in OFF mode
  - 200 nA max. in OFF mode at 125 °C
- Output voltage tolerance: ± 2% at 25 °C
- 150 mA guaranteed output current
- Wide range of output voltages: 0.8 V to 3.3 V in 100 mV steps
- Logic-controlled electronic shutdown
- Compatible with ceramic capacitor (C_{OUT} = 1 µF)
- Internal current and thermal limit
- Temperature range: from -40 °C to 125 °C

Application

- Mobile phones
- Digital still cameras (DSC)
- Battery-powered equipment
- Portable media players

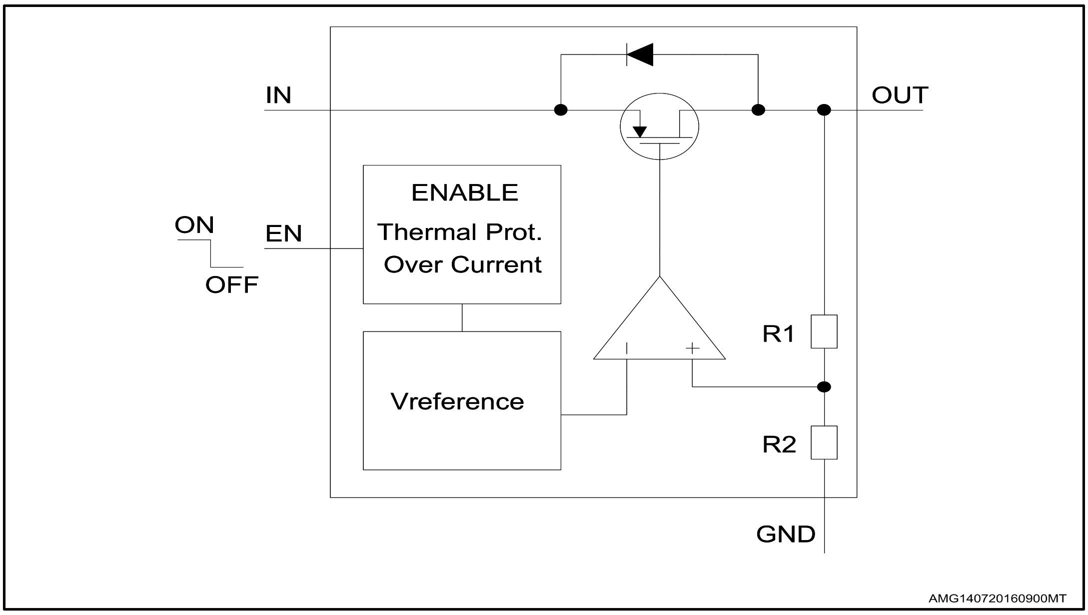
Description

The STLQ015 provides 150 mA of maximum current with an input voltage range from 1.5 V to 5.5 V and a typical dropout voltage of 112 mV. The key feature of this device is its quiescent current, which is just 1.4 µA at maximum output current. The device is stable with a ceramic capacitor on the output. It offers very low quiescent current and extends battery-life of applications requiring very long standby time. The enable logic control function puts the STLQ015 in shutdown mode, reducing total current consumption to 1 nA. The device also includes short-circuit constant-current limiting and thermal protection. Typical applications are: portable and battery-powered systems, electronic sensors and microcontroller power supply.

Contents

1 Block diagram

Figure 1: Device block diagram



2 Pin configuration and description

Figure 2: Pin configuration (top view)

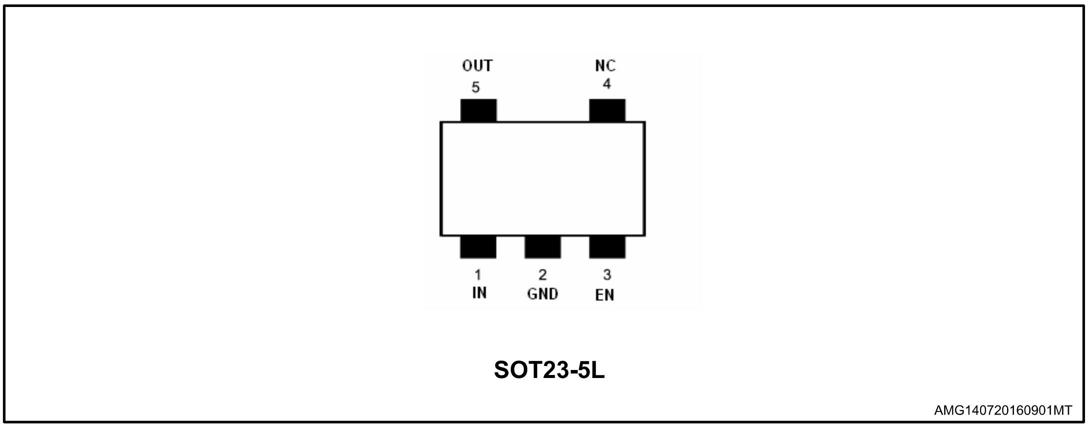
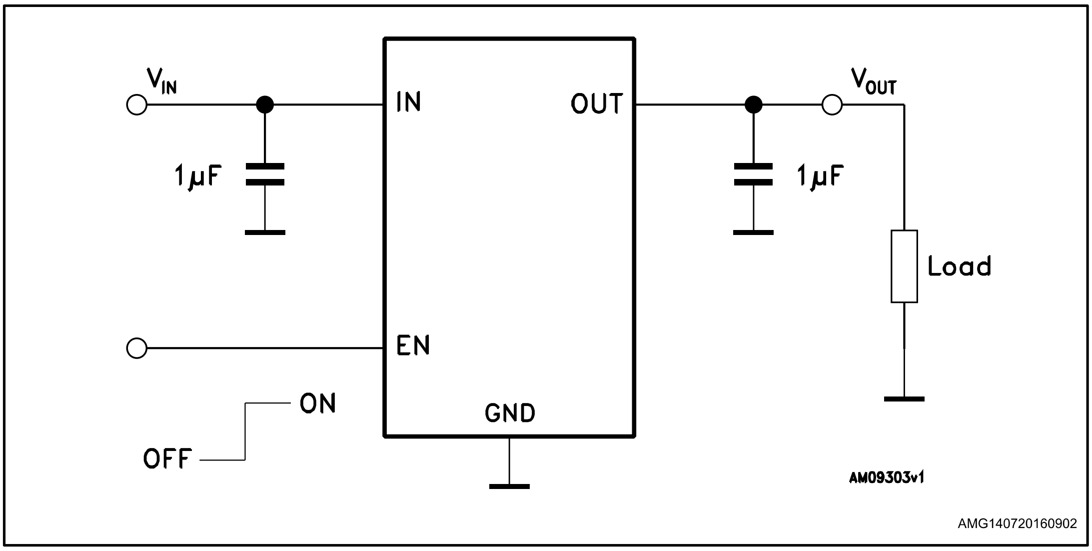


Table 1: Pin description

Pin	Symbol	Functions
3	EN	Enable input Set V_{EN} = high to turn on the device Set V_{EN} = low to turn off the device
2	GND	Ground
1	IN	Input voltage
5	OUT	Output voltage
4	NC	Not connected

3 Typical application

Figure 3: Typical application circuit



4 Maximum ratings

Table 2: 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_{IN}+0.3	V
V_{EN}	Enable input voltage	-0.3 to V_{IN}+0.3	V
I_{OUT}	Output current	Internally limited	mA
ESD	Human body model	±3	kV
	Machine model	±300	V
P_D	Power dissipation	Internally limited	mW
T_{STG}	Storage temperature range	-65 to 150	°C
T_{OP}	Max. junction temperature	150	°C

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 3: Thermal data

Symbol	Parameter	Value	Unit
R_{thJA}	Thermal resistance junction-ambient	255	°C/W
R_{thJC}	Thermal resistance junction-case	81	°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 4: Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage	I_{OUT} = 0	1.5		5.5	V
		-40 °C < T_J < 125 °C, I_{OUT} = 150 mA	1.55		5.5	
V_{OUT}	V_{OUT} accuracy	I_{OUT} = 1 mA	-2		2	%
		I_{OUT} = 1 mA, V_{OUT} < 1 V	-20		+20	mV
		I_{OUT} = 1 mA, -40 °C < T_J < 125 °C	-3		3	%
$\Delta V_{OUT\text{-}LINE}$	Static line regulation	V_{OUT} +1 V ≤ V_{IN} ≤ 5.5 V, I_{OUT} = 1 mA		±0.01		%/V
$\Delta V_{OUT\text{-}LOAD}$	Static load regulation	I_{OUT} = 1 mA to 150 mA		±0.002		%/mA
V_{DROP}	Dropout voltage (1)	I_{OUT} = 150 mA		112		mV
		I_{OUT} = 150 mA, -40 °C < T_J < 125 °C			300	
e_N	Output noise voltage	10 kHz to 100 kHz, I_{OUT} = 10 mA, V_{OUT} = 0.8 V		75		µV_{RMS}
SVR	Supply voltage rejection V_{OUT} = 0.8 V	V_{IN} = V_{OUTNOM} + 1 V +/-V_{RIPPLE} V_{RIPPLE} = 0.1 V, frequency = 1 kHz I_{OUT} = 10 mA		40		dB
		V_{IN} = V_{OUTNOM} + 1 V +/-V_{RIPPLE} V_{RIPPLE} = 0.1 V, frequency =10 kHz I_{OUT} = 1 mA		30		
		V_{IN} = V_{OUTNOM} + 1 V +/-V_{RIPPLE} V_{RIPPLE} = 0.1 V, frequency = 100 kHz I_{OUT} = 1 mA		15		
I_Q	Quiescent current	I_{OUT} = 0		1.0	1.7	µA
		I_{OUT} = 0 to 150 mA, -40 °C < T_J < 125 °C		1.4	2.4	
I_{OFF}	Shutdown current (2)	V_{IN} input current in OFF mode: V_{EN} = GND, -40 °C < T_J < 125 °C		1	200	nA
I_{SC}	Short-circuit current	R_L = 0	250	350		mA
V_{EN}	Enable input logic low	V_{IN} = 1.5 V to 5.5 V			0.4	V
	Enable input logic high	V_{IN} = 1.5 V to 5.5 V	0.7			V

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{EN}	Enable pin input current	V_{EN} = 5.5 V		1	200	nA
T_{ON}	Turn-on time [(3)]	V_{OUT} = 0.8 V, I_{OUT} = 150 mA		160		µs
T_{SHDN}	Thermal shutdown			170		°C
	Hysteresis			15		
C_{OUT}	Output capacitor	Capacitance (see typical performance characteristics for stability)	0.47		10	µF
	ESR		0.056		6	Ω

Notes:

[(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 to output voltages below 1.5 V.

[(2)]During shutdown and at no load, P-channel leakage current flowing through the internal resistor divider causes the V_{OUT} rise.

[(3)]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

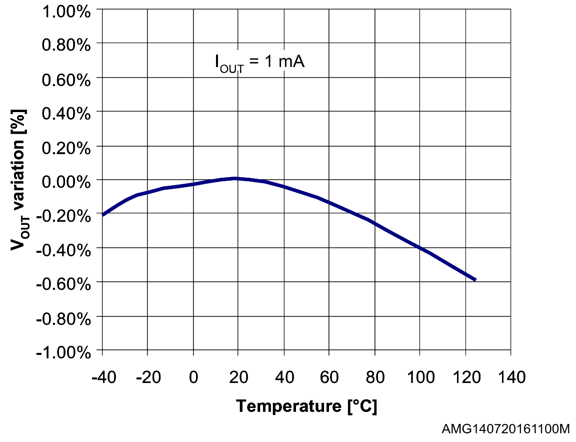


Figure 5: Output voltage vs input voltage (V_{OUT} = 0.8 V)

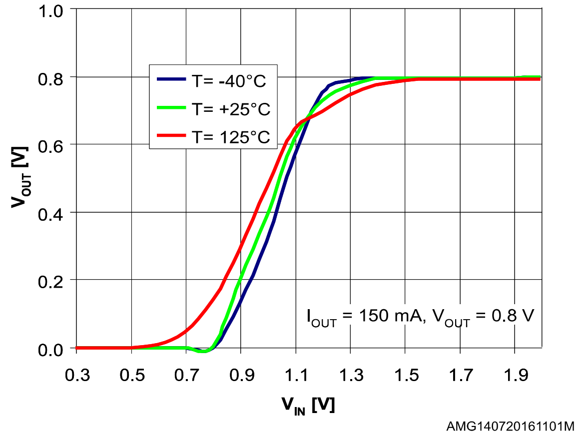


Figure 6: Output voltage vs input voltage (V_{OUT} = 3.3 V)

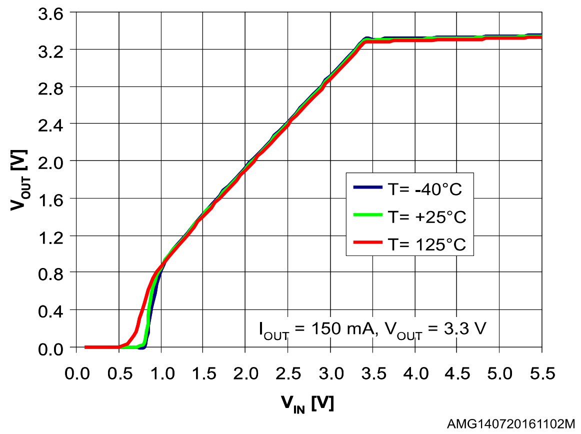


Figure 7: Dropout voltage vs temperature

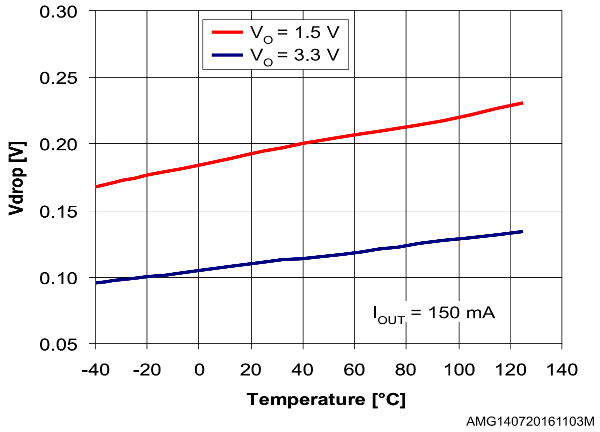


Figure 8: Dropout voltage vs temperature

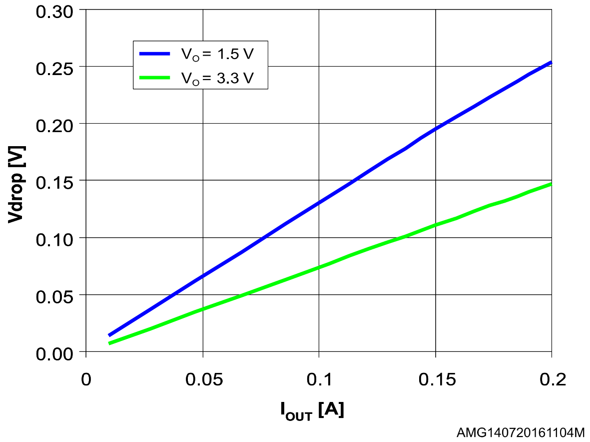


Figure 9: Quiescent current vs temperature

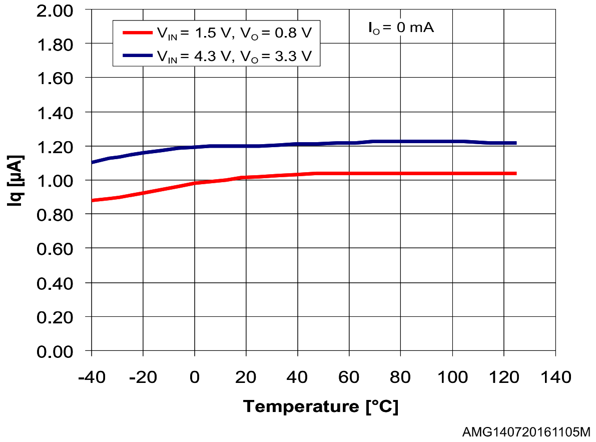


Figure 10: Supply voltage rejection vs frequency

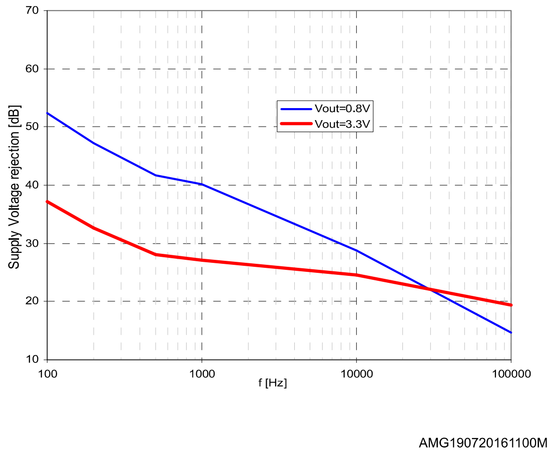


Figure 11: Supply voltage rejection vs I_{OUT}

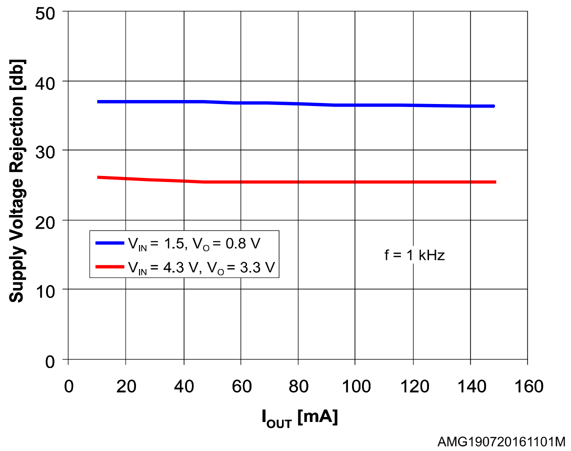


Figure 12: Quiescent current vs input voltage

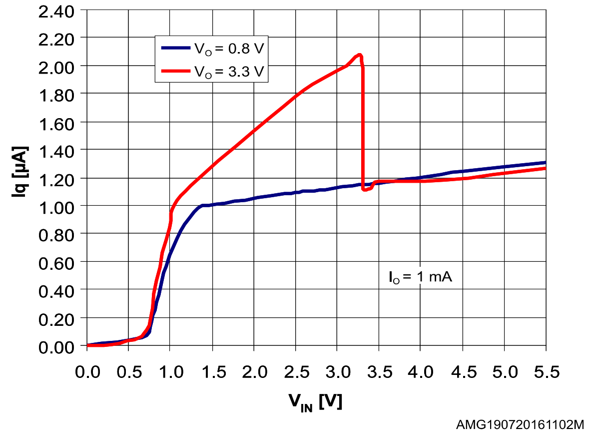


Figure 13: Quiescent current vs output current

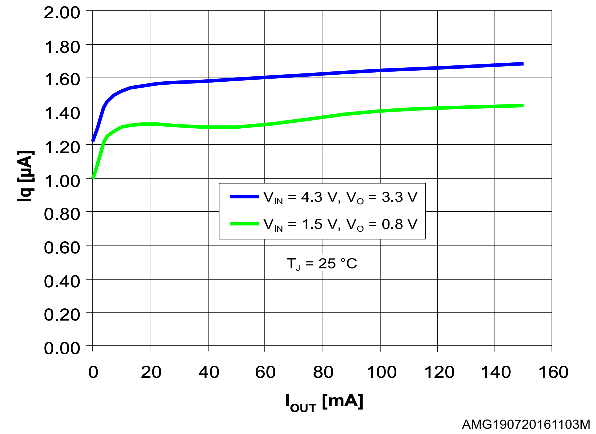
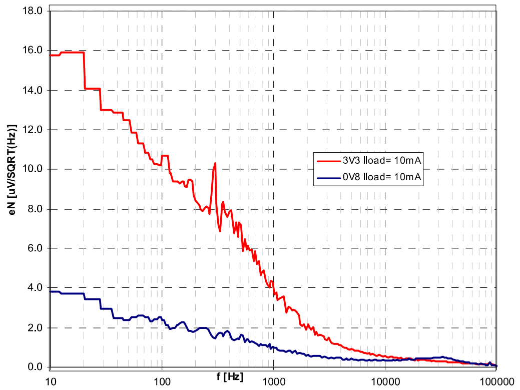
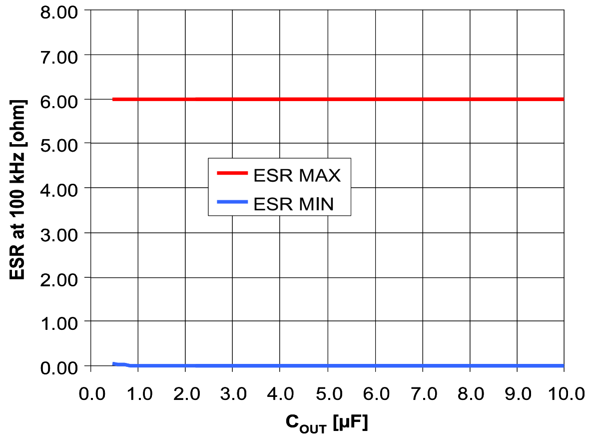


Figure 14: Output noise voltage vs frequency



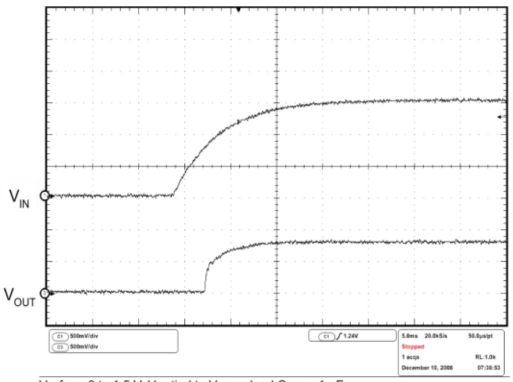
AMG190720161104M

Figure 15: C_{OUT} stability region



AMG190720161105M

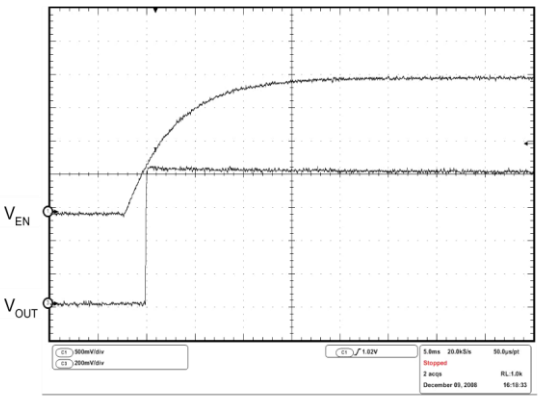
Figure 16: Start-up transient



V_{IN} from 0 to 1.5 V, V_{EN} tied to V_{IN}, no load C_{OUT} = 1 µF

AMG190720161106M

Figure 17: Enable transient



V_{IN} = 1.5 V; V_{EN} from 0 to 2 V, no load, T = 25 °C

AMG190720161107M

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 SOT23-5L package information

Figure 18: SOT23-5L package outline

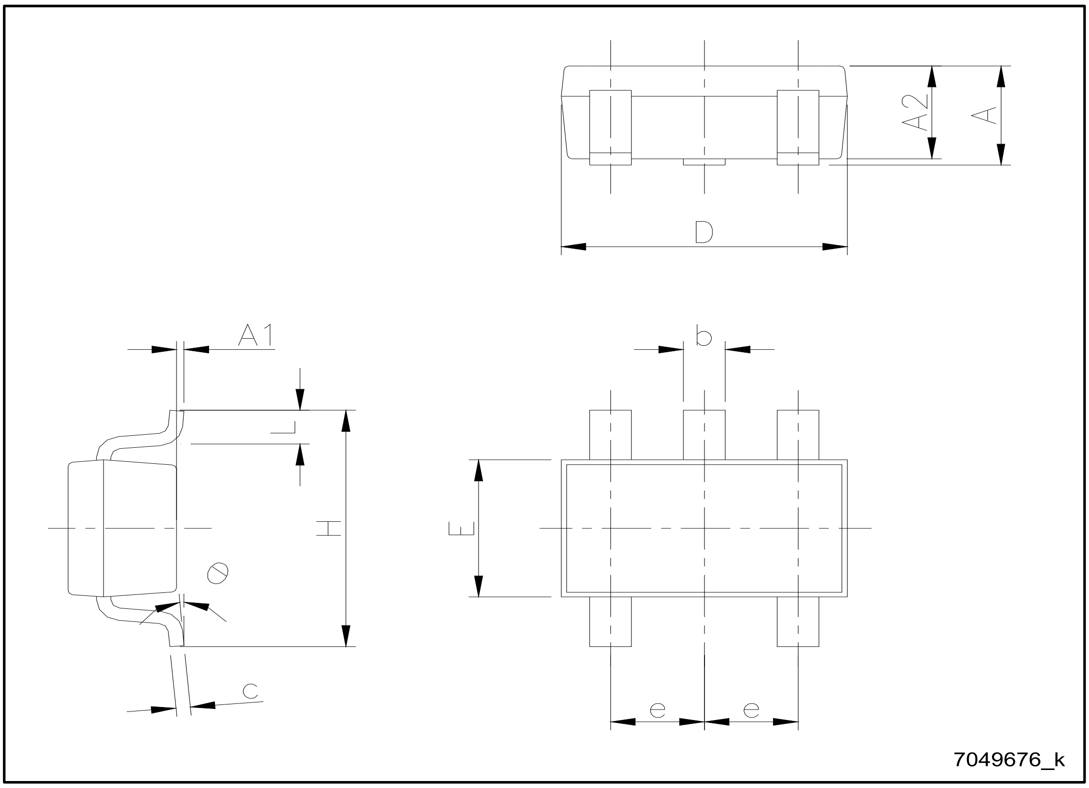
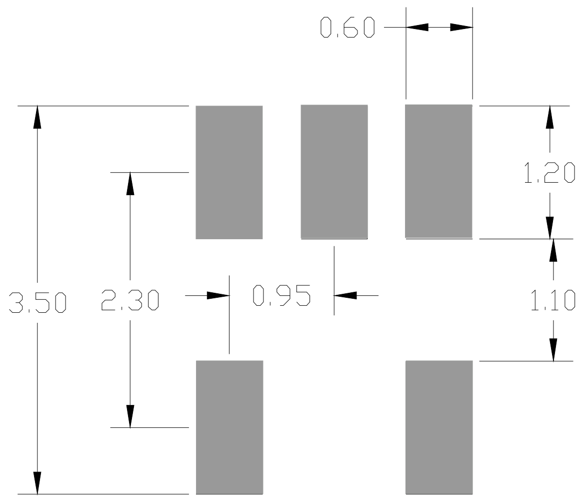


Table 5: SOT23-5L package mechanical data

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 19: SOT23-5L recommended footprint



Dimensions are in mm

7.2 SOT23-5L packing information

Figure 20: SOT23-5L tape and reel outline

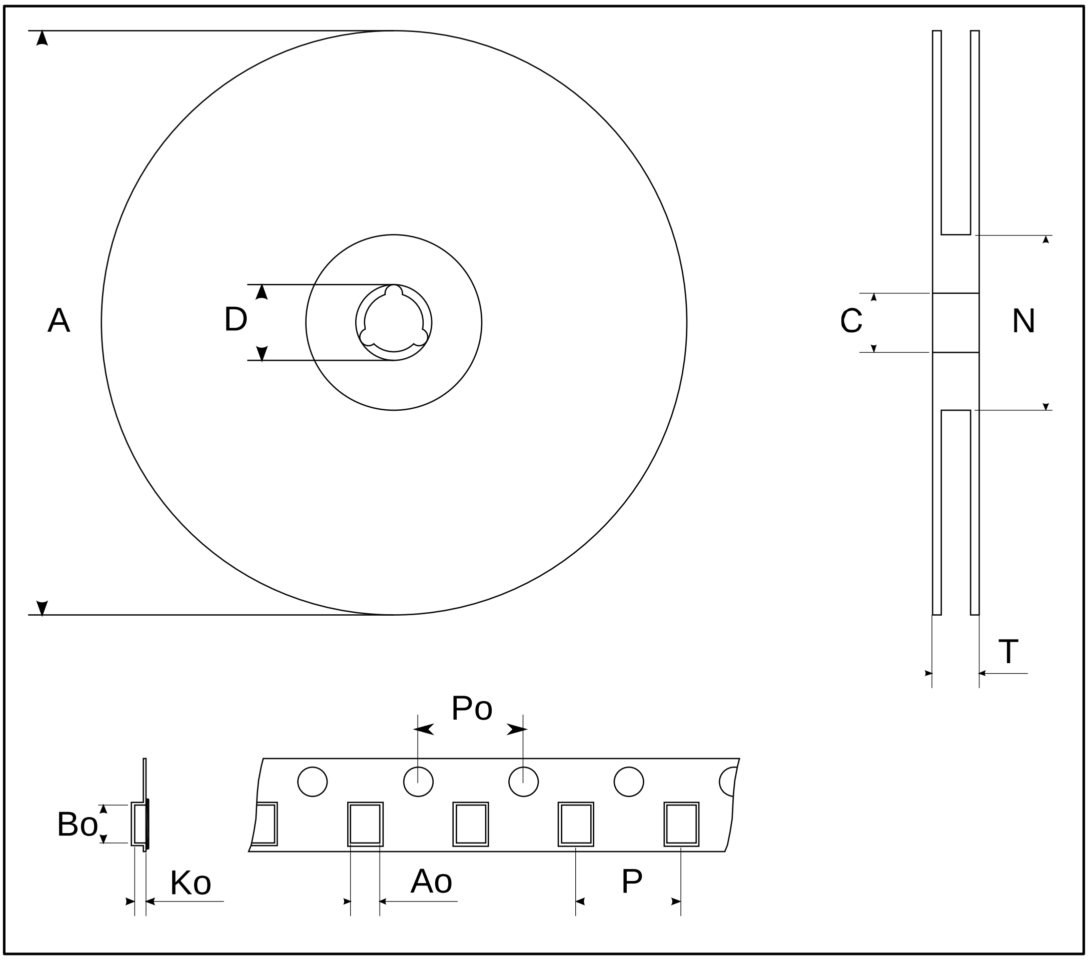


Table 6: SOT23-5L tape and reel mechanical data

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

8 Ordering information

Table 7: Order code

Order code	Output voltage	Package	Marking
STLQ015M12R	1.2 V	SOT23-5L	1512
STLQ015M15R	1.5 V		1515
STLQ015M18R	1.8 V		1518
STLQ015M21R	2.1 V		1521
STLQ015M25R	2.5 V		1525
STLQ015M28R	2.8 V		1528
STLQ015M30R	3.0 V		1530
STLQ015M31R	3.1 V		1531
STLQ015M33R	3.3 V		1533

9 Revision history

Table 8: Document revision history

Date	Revision	Changes
23-Mar-2010	1	Initial release.
20-Jan-2011	2	Modified: Table 5 on page 13 and Figure 18. Added: Figure 19.
11-Sep-2012	3	Added: new order codes STLQ015XG12R, STLQ015XG15R and STLQ015XG18R to the device summary table.
17-Feb-2014	4	Changed the part number STLQ015xx to STLQ015. Changed the title in cover page. Updated Description and Table : in cover page. Changed typ. value of I_Q parameter in Table 4: Electrical characteristics. Minor text changes.
03-Jul-2015	5	Added package SOT23-5L. Updated *Table 1.: Pin description*, *Table 3.: Thermal data* and *Figure 2.: Pin configuration (top view)* Updated *8: Order code*. Updated *Section 7: Package information*. Minor text changes.
02-Sep-2016	6	Updated *Section 8: "Ordering information"*. Minor text changes.