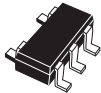


## 150 mA, ultra low quiescent current linear voltage regulator



SOT23-5L

### Features

- Input voltage from 1.5 to 5.5 V
- Very low quiescent current:
  - 1.0  $\mu\text{A}$  (typ.) at no load
  - 1.4  $\mu\text{A}$  (typ.) at 150 mA load
  - 1 nA (typ.) in OFF mode
  - 200 nA max. in OFF mode at 125 °C
- Output voltage tolerance:  $\pm 2\%$  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 ( $C_{\text{OUT}} = 1 \mu\text{F}$ )
- 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

Maturity status link

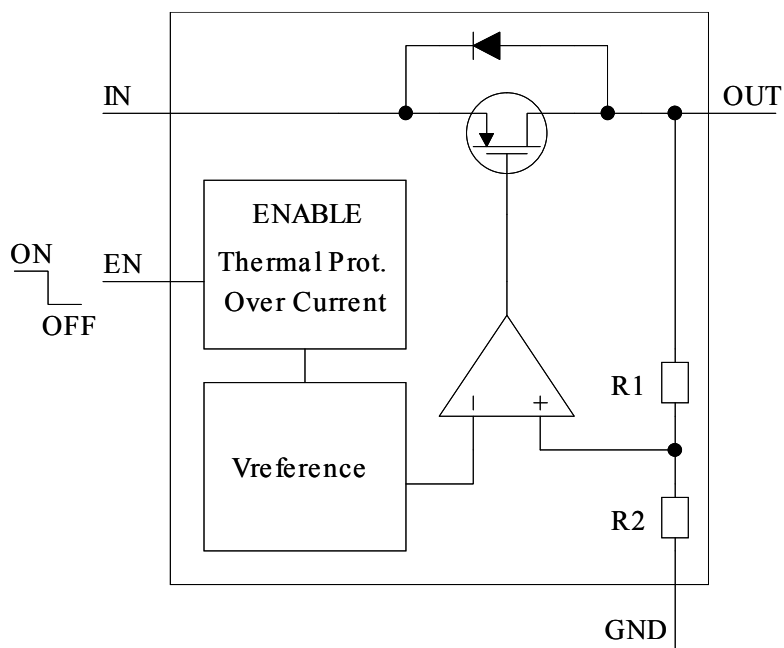
[STLQ015](#)

### 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  $\mu\text{A}$  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.

# 1 Block diagram

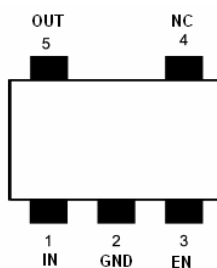
Figure 1. Device block diagram



AMG140720160900MT

## 2 Pin configuration and description

**Figure 2. Pin configuration (top view)**



**SOT23-5L**

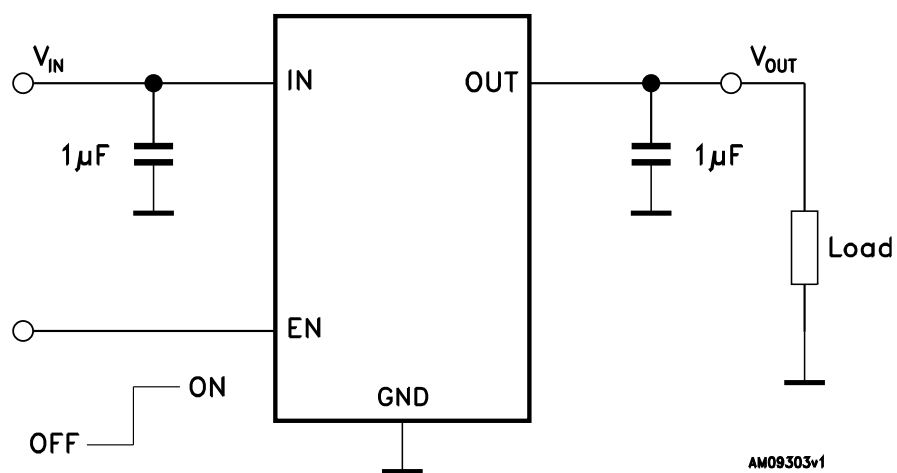
AMG140720160901MT

**Table 1. Pin description**

| Pin | Symbol | Functions                                                                                              |
|-----|--------|--------------------------------------------------------------------------------------------------------|
| 3   | EN     | Enable input<br>Set $V_{EN}$ = high to turn on the device<br>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



AMG140720160902

## 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          | $\pm 3$              | kV   |
|           | Machine model             | $\pm 300$            | V    |
| $P_D$     | Power dissipation         | Internally limited   | mW   |
| $T_{STG}$ | Storage temperature range | -65 to 150           | °C   |
| $T_{OP}$  | Max. junction temperature | 150                  | °C   |

**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 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

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

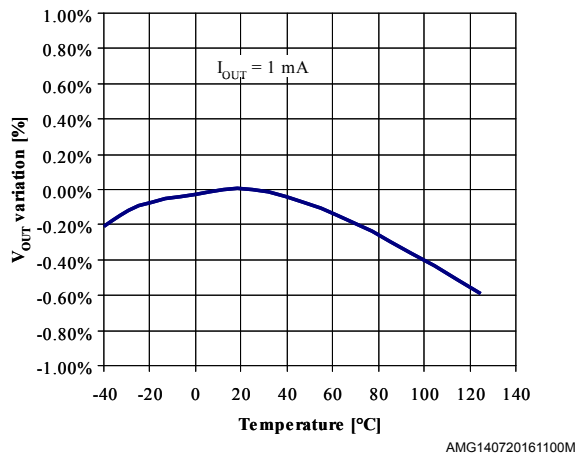
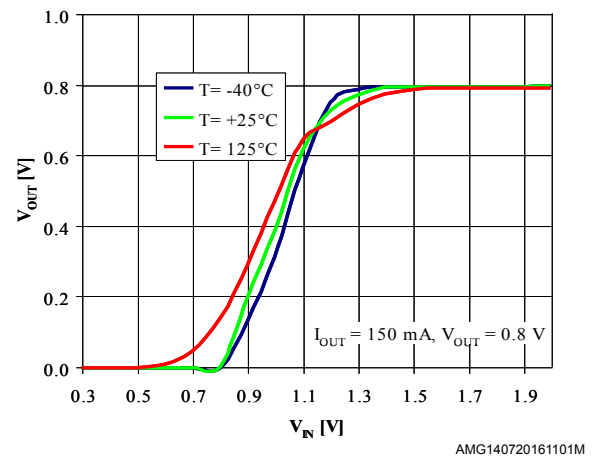
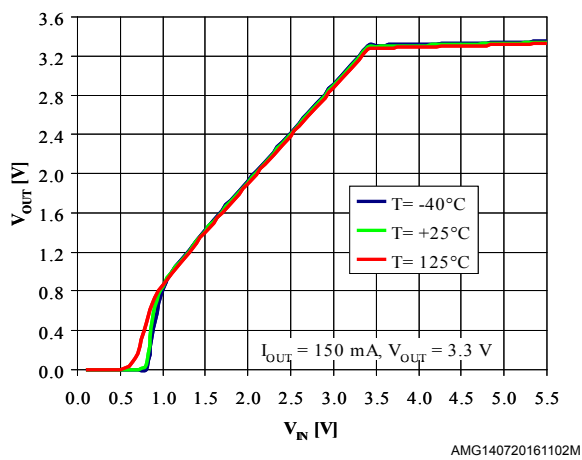
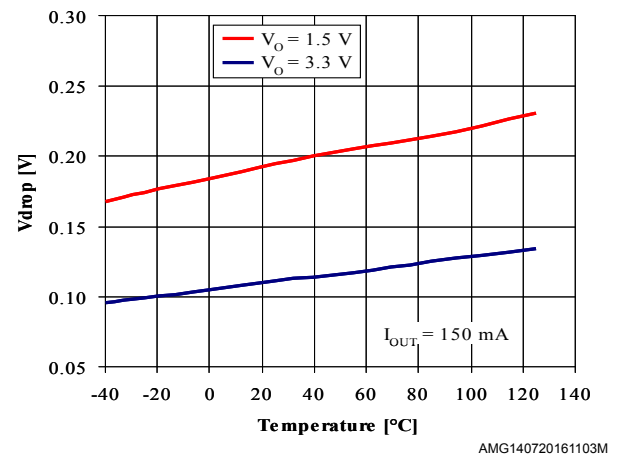
**Table 4. Electrical characteristics**

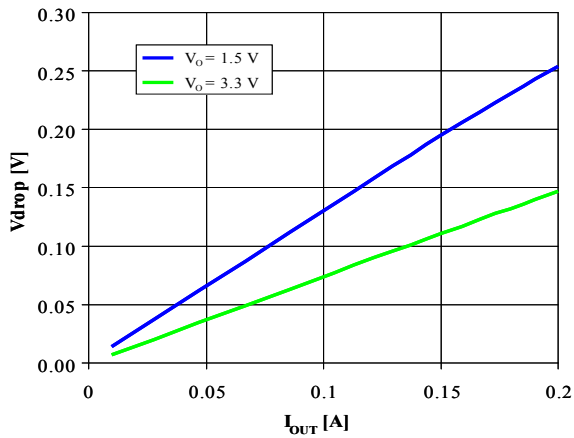
| Symbol                | Parameter                                            | Test conditions                                                                                                                   | Min. | Typ.        | Max. | Unit                |
|-----------------------|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|------|-------------|------|---------------------|
| $V_{IN}$              | Operating input voltage                              | $I_{OUT} = 0$                                                                                                                     | 1.5  |             | 5.5  | V                   |
|                       |                                                      | $-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$ , $I_{OUT} = 150\text{ mA}$                                     | 1.55 |             | 5.5  |                     |
| $V_{OUT}$             | $V_{OUT}$ accuracy                                   | $I_{OUT} = 1\text{ mA}$                                                                                                           | -2   |             | 2    | %                   |
|                       |                                                      | $I_{OUT} = 1\text{ mA}$ , $V_{OUT} < 1\text{ V}$                                                                                  | -20  |             | +20  | mV                  |
|                       |                                                      | $I_{OUT} = 1\text{ mA}$ , $-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$                                       | -3   |             | 3    | %                   |
| $\Delta V_{OUT-LINE}$ | Static line regulation                               | $V_{OUT} + 1\text{ V} \leq V_{IN} \leq 5.5\text{ V}$ ,<br>$I_{OUT} = 1\text{ mA}$                                                 |      | $\pm 0.01$  |      | %/V                 |
| $\Delta V_{OUT-LOAD}$ | Static load regulation                               | $I_{OUT} = 1\text{ mA}$ to $150\text{ mA}$                                                                                        |      | $\pm 0.002$ |      | %/mA                |
| $V_{DROP}$            | Dropout voltage <sup>(1)</sup>                       | $I_{OUT} = 150\text{ mA}$                                                                                                         |      | 112         |      | mV                  |
|                       |                                                      | $I_{OUT} = 150\text{ mA}$ , $-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$                                     |      |             | 300  |                     |
| $e_N$                 | Output noise voltage                                 | 10 kHz to 100 kHz, $I_{OUT} = 10\text{ mA}$ , $V_{OUT} = 0.8\text{ V}$                                                            |      | 75          |      | $\mu\text{V}_{RMS}$ |
| SVR                   | Supply voltage rejection<br>$V_{OUT} = 0.8\text{ V}$ | $V_{IN} = V_{OUTNOM} + 1\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$ ,<br>frequency = 1 kHz<br>$I_{OUT} = 10\text{ mA}$  |      | 40          |      | dB                  |
|                       |                                                      | $V_{IN} = V_{OUTNOM} + 1\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$ ,<br>frequency = 10 kHz<br>$I_{OUT} = 1\text{ mA}$  |      | 30          |      |                     |
|                       |                                                      | $V_{IN} = V_{OUTNOM} + 1\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$ ,<br>frequency = 100 kHz<br>$I_{OUT} = 1\text{ mA}$ |      | 15          |      |                     |
| $I_Q$                 | Quiescent current                                    | $I_{OUT} = 0$                                                                                                                     |      | 1.0         | 1.7  | $\mu\text{A}$       |
|                       |                                                      | $I_{OUT} = 0$ to $150\text{ mA}$ ,<br>$-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$                           |      | 1.4         | 2.4  |                     |
| $I_{OFF}$             | Shutdown current <sup>(2)</sup>                      | $V_{IN}$ input current in OFF mode:<br>$V_{EN} = \text{GND}$ , $-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$  |      | 1           | 200  | nA                  |
| $I_{SC}$              | Short-circuit current                                | $R_L = 0$                                                                                                                         | 250  | 350         |      | mA                  |
| $V_{EN}$              | Enable input logic low                               | $V_{IN} = 1.5\text{ V}$ to $5.5\text{ V}$                                                                                         |      |             | 0.4  | V                   |
|                       | Enable input logic high                              | $V_{IN} = 1.5\text{ V}$ to $5.5\text{ V}$                                                                                         | 0.7  |             |      | V                   |
| $I_{EN}$              | Enable pin input current                             | $V_{EN} = 5.5\text{ V}$                                                                                                           |      | 1           | 200  | nA                  |
| $T_{ON}$              | Turn-on time <sup>(3)</sup>                          | $V_{OUT} = 0.8\text{ V}$ , $I_{OUT} = 150\text{ mA}$                                                                              |      | 160         |      | $\mu\text{s}$       |
| $T_{SHDN}$            | Thermal shutdown                                     |                                                                                                                                   |      | 170         |      | $^{\circ}\text{C}$  |
|                       | Hysteresis                                           |                                                                                                                                   |      | 15          |      |                     |

| Symbol           | Parameter        | Test conditions                                                     | Min.  | Typ. | Max. | Unit |
|------------------|------------------|---------------------------------------------------------------------|-------|------|------|------|
| C <sub>OUT</sub> | Output capacitor | Capacitance (see typical performance characteristics for stability) | 0.47  |      | 10   | μF   |
|                  | ESR              |                                                                     | 0.056 |      | 6    | Ω    |

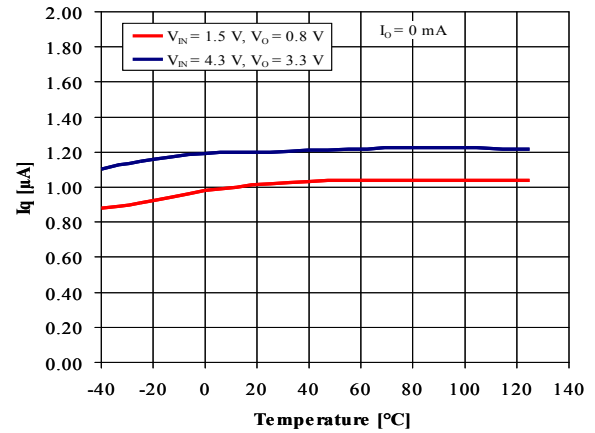
1. Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value. This specification does not apply to output voltages below 1.5 V.
2. During shutdown and at no load, P-channel leakage current flowing through the internal resistor divider causes the V<sub>OUT</sub> rise.
3. Turn-on time is the time measured between the enable input just exceeding V<sub>EN</sub> high value and the output voltage just reaching 95% of its nominal value.

## 6 Typical performance characteristics

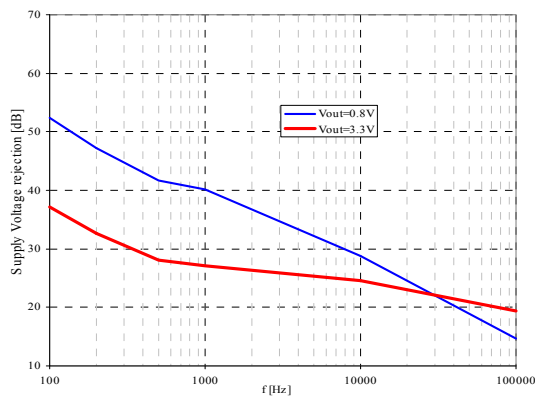
**Figure 4. Output voltage vs. temperature**

**Figure 5. Output voltage vs. input voltage ( $V_{OUT} = 0.8 \text{ V}$ )**

**Figure 6. Output voltage vs. input voltage ( $V_{OUT} = 3.3 \text{ V}$ )**

**Figure 7. Dropout voltage vs. temperature**


**Figure 8. Dropout voltage vs. temperature**


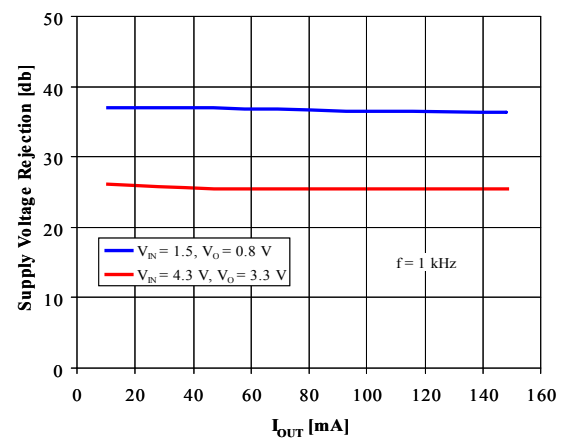
AMG140720161104M

**Figure 9. Quiescent current vs. temperature**


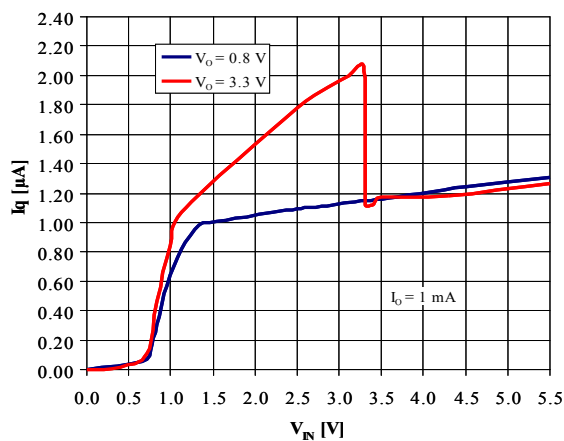
AMG140720161105M

**Figure 10. Supply voltage rejection vs. frequency**


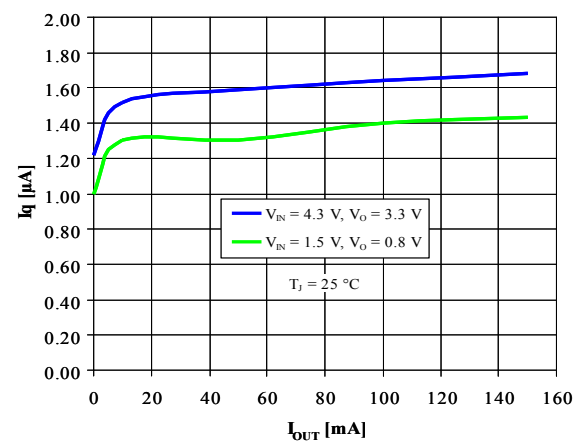
AMG190720161100M

**Figure 11. Supply voltage rejection vs. IOUT**


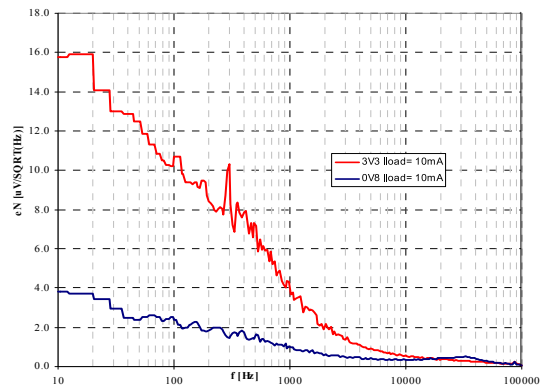
AMG190720161101M

**Figure 12. Quiescent current vs. input voltage**


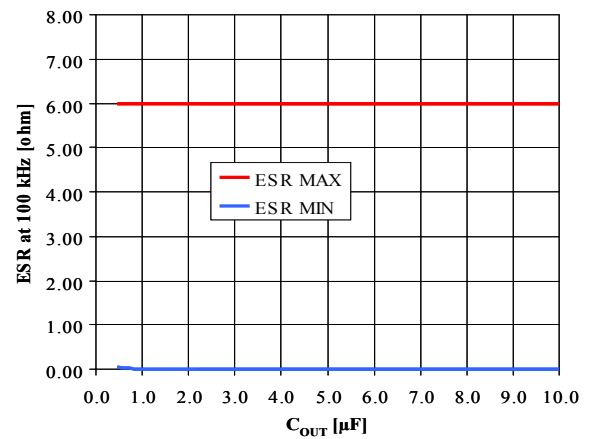
AMG190720161102M

**Figure 13. Quiescent current vs. output current**


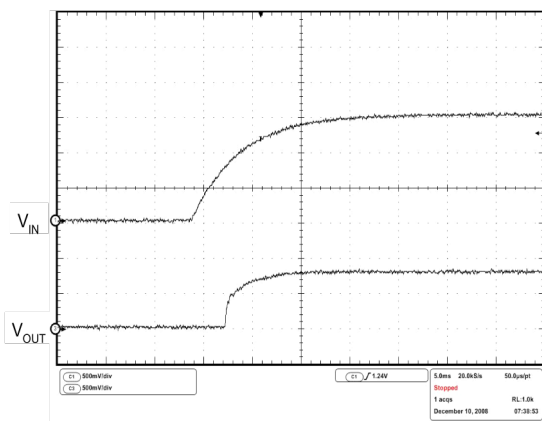
AMG190720161103M

**Figure 14. Output noise voltage vs. frequency**


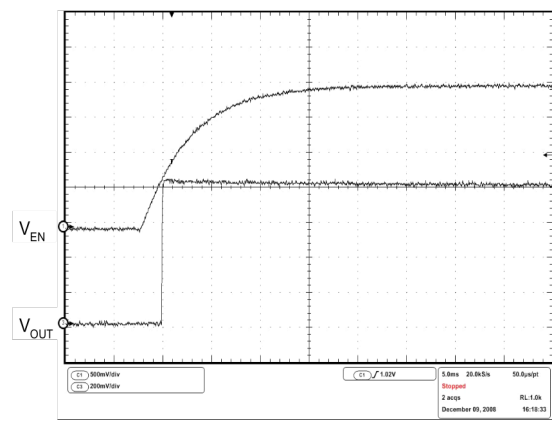
AMG190720161104M

**Figure 15. C<sub>OUT</sub> stability region**


AMG190720161105M

**Figure 16. Start-up transient**

 $V_{IN}$  from 0 to 1.5 V,  $V_{EN}$  tied to  $V_{IN}$ , no load  $C_{OUT} = 1 \mu F$ 

AMG190720161106M

**Figure 17. Enable transient**

 $V_{IN} = 1.5 V$ ;  $V_{EN}$  from 0 to 2 V, no load,  $T = 25^\circ C$ 

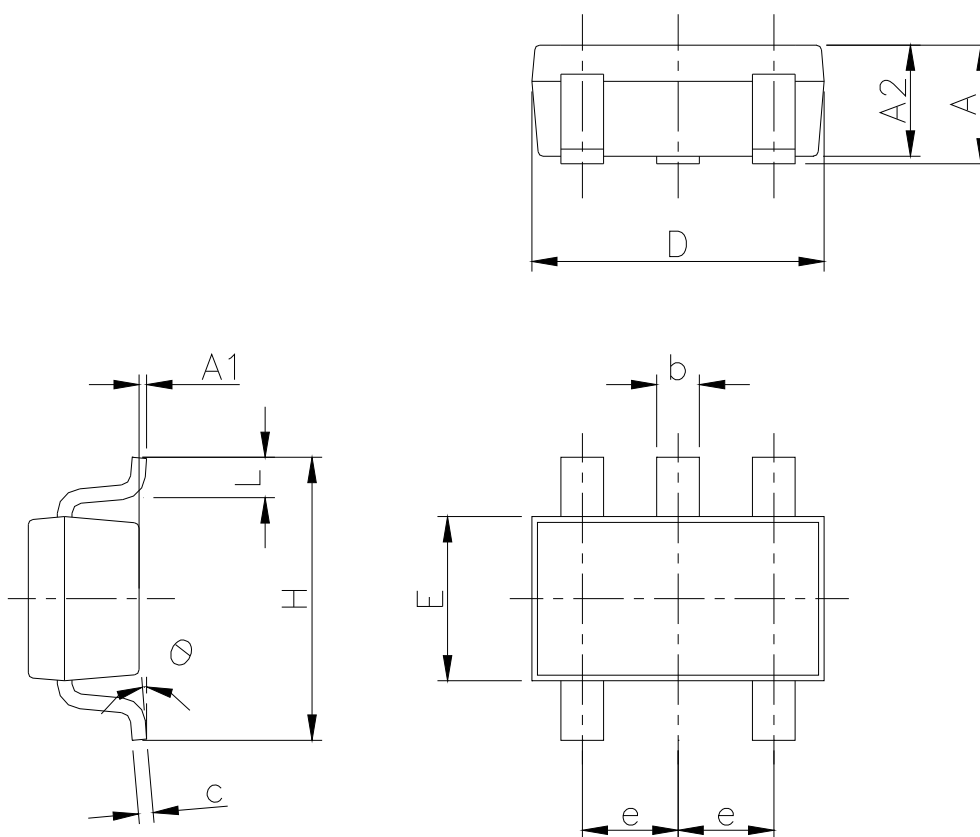
AMG190720161107M

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

### 7.1 SOT23-5L mechanical data

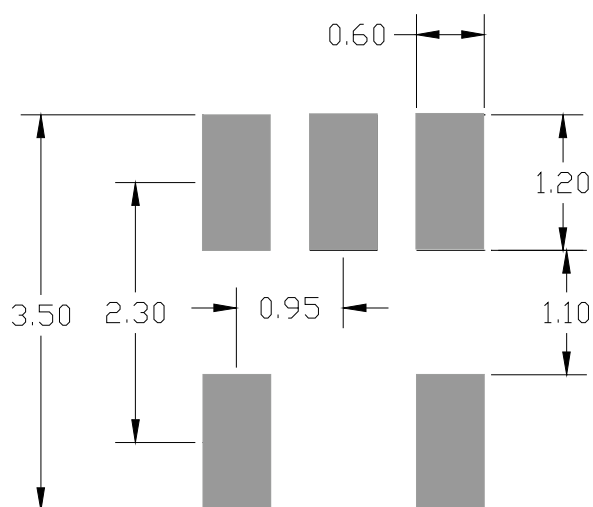
Figure 18. SOT23-5L package outline



7049676\_k

**Table 5. SOT23-5L package mechanical data**

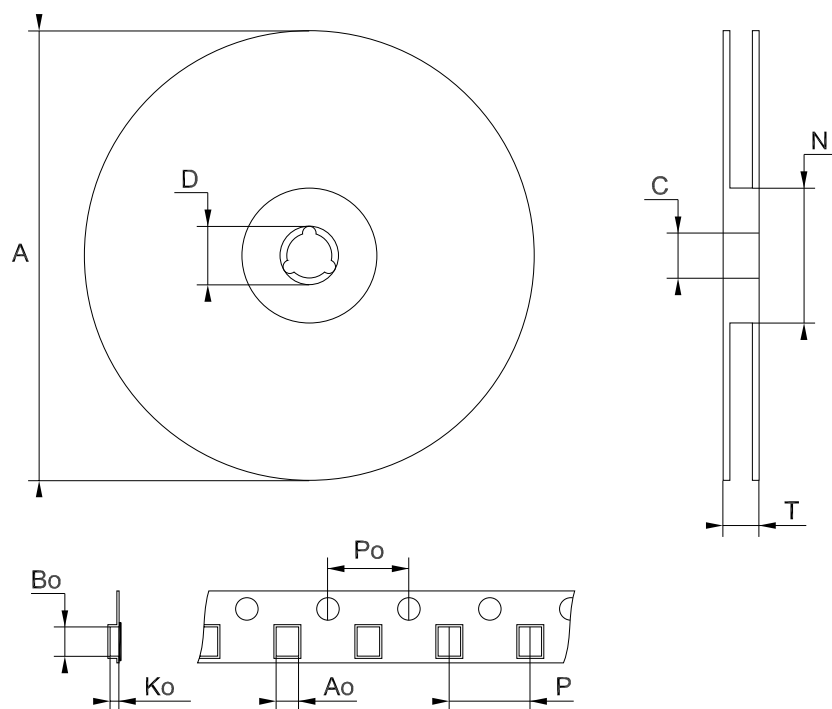
| Dim.     | mm   |      |      |
|----------|------|------|------|
|          | Min. | Typ. | Max. |
| A        | 0.90 |      | 1.45 |
| A1       | 0    |      | 0.15 |
| A2       | 0.90 |      | 1.30 |
| b        | 0.30 |      | 0.50 |
| c        | 0.09 |      | 0.20 |
| D        |      | 2.95 |      |
| E        |      | 1.60 |      |
| e        |      | 0.95 |      |
| H        |      | 2.80 |      |
| L        | 0.30 |      | 0.60 |
| $\theta$ | 0°   |      | 8°   |

**Figure 19. SOT23-5L recommended footprint**


**Note:** Dimensions are in mm

## 7.2 SOT23-5L packing information

**Figure 20.** SOT23-5L tape and reel outline



Note: Drawing not in scale

**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    |
| STLQ015M20R | 2.0 V          |          | 1520    |
| 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    |

## 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.<br>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.<br>Changed the title in cover page.<br>Updated Description and Table : in cover page.<br>Changed typ. value of $I_Q$ parameter in Table 4: Electrical characteristics.<br>Minor text changes. |
| 03-Jul-2015 | 5        | Added package SOT23-5L.<br>Updated Table 1.: Pin description, Table 3.: Thermal data and Figure 2.: Pin configuration (top view)<br>Updated 8: Order code.<br>Updated Section 7: Package information.<br>Minor text changes.                |
| 02-Sep-2016 | 6        | Updated Section 8: "Ordering information".<br>Minor text changes.                                                                                                                                                                           |
| 14-Feb-2020 | 7        | Added new part number STLQ015M20R in <a href="#">Table 7</a> .                                                                                                                                                                              |

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