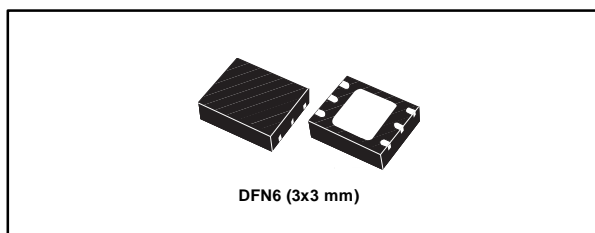


## 1 A, low quiescent current, low-noise voltage regulator

Datasheet - production data



### Features

- Industrial & Automotive grade (AEC-Q100)
- Input voltage from 1.5 to 5.5 V
- Ultra low-dropout voltage (200 mV typ. at 1 A load)
- Very low quiescent current (20  $\mu$ A typ. at no load, 200  $\mu$ A typ. at 1 A load, 1  $\mu$ A max. in off mode)
- Very low-noise with no bypass capacitor (30  $\mu$  V<sub>RMS</sub> at V<sub>OUT</sub> = 0.8 V)
- Output voltage tolerance:  $\pm$  2.0% @ 25 °C
- 1 A guaranteed output current
- Wide range of output voltages available on request: 0.8 V to 4.5 V with 100 mV step and adjustable from 0.8 V
- Logic-controlled electronic shutdown
- Stable with ceramic capacitors C<sub>OUT</sub> = 1  $\mu$ F
- Internal current and thermal limit
- DFN6 (3x3 mm) package
- Temperature range: - 40 °C to 125 °C

### Applications

- Printers
- Game consoles
- Computer
- Consumer applications
- Automotive post regulation

### Description

The LD39100 provides 1 A maximum current with an input voltage range from 1.5 V to 5.5 V and a typical dropout voltage of 200 mV. The device is stable with ceramic capacitors on the input and output. 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 70 dB at low frequency and starts to roll off at 10 kHz. Enable logic control function puts the LD39100 in shutdown mode, allowing a total current consumption lower than 1  $\mu$ A. The device also includes short-circuit constant current limiting and thermal protection. LD39100 is available also in AEC-Q100 qualified version, in the DFN6 (3x3 mm) with wettable flank package.

**Contents**

**1 Circuit schematics..... 3**

**2 Pin configuration ..... 4**

**3 Maximum ratings ..... 5**

**4 Electrical characteristics ..... 6**

**5 Typical performance characteristics ..... 10**

**6 Application information ..... 15**

    6.1 Power dissipation ..... 16

    6.2 Enable function ..... 17

    6.3 Power Good function..... 17

**7 Package information ..... 18**

    7.1 DFN6 (3x3 mm) package information ..... 19

    7.2 DFN6 (3x3 mm) package information (automotive-grade) ..... 21

    7.3 DFN6 (3x3 mm) packing information..... 23

**8 Ordering information..... 25**

**9 Revision history ..... 26**

# 1 Circuit schematics

Figure 1: LD39100 schematic diagram (adjustable version)

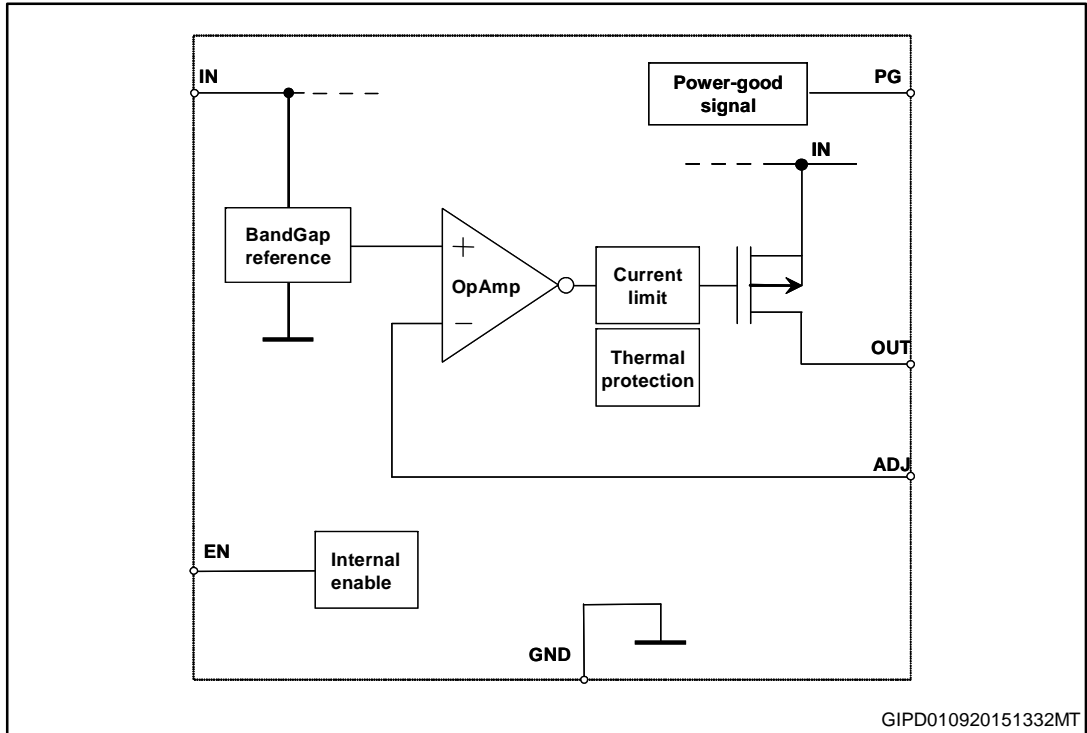
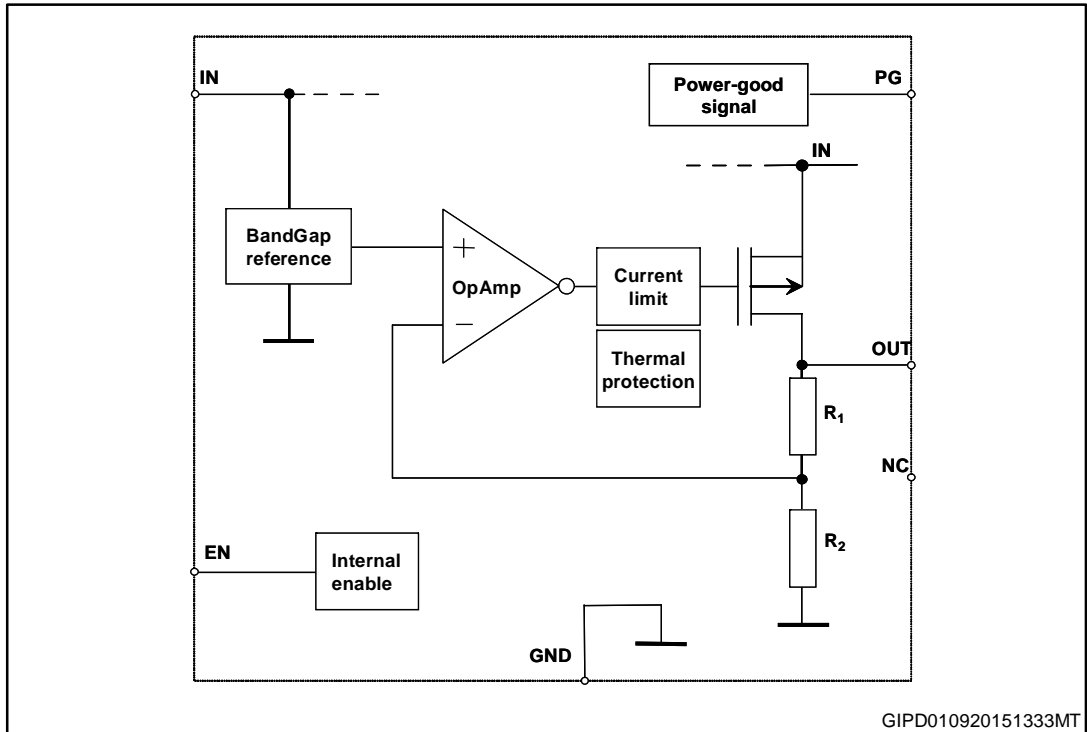


Figure 2: LD39100 schematic diagram (fixed version)



## 2 Pin configuration

Figure 3: Pin connection (top view)

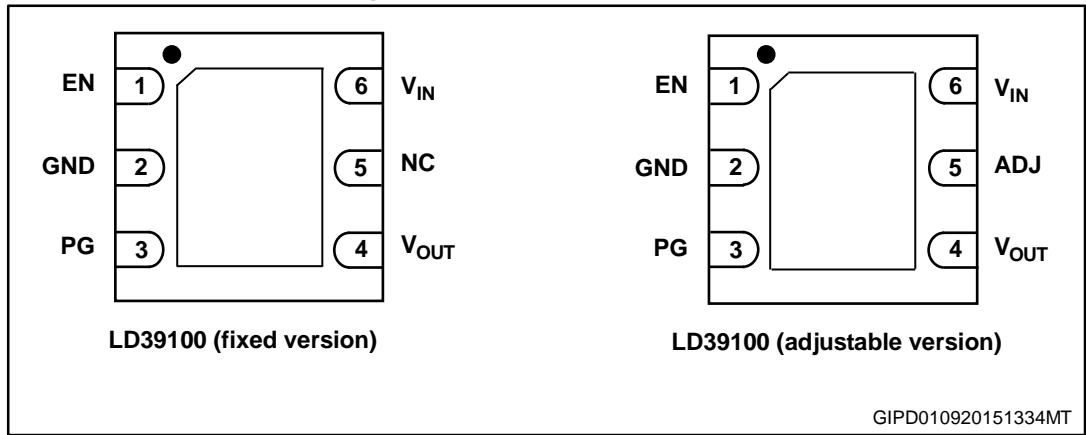


Table 1: Pin description

| Symbol           | Pin                             |                            | Function  |
|------------------|---------------------------------|----------------------------|---|
|                  | LD39100<br>(adjustable version) | LD39100<br>(fixed version) |   |
| EN               | 1                               | 1                          | Enable pin logic input: low = shutdown, high = active |
| GND              | 2                               | 2                          | Common ground   |
| PG               | 3                               | 3                          | Power Good  |
| V <sub>OUT</sub> | 4                               | 4                          | Output voltage  |
| ADJ              | 5                               | -                          | Adjust pin  |
| V <sub>IN</sub>  | 6                               | 6                          | LDO input voltage                                     |
| NC               | -                               | 5                          | Not connected   |
| GND              | Exposed pad                     |                            | Exposed pad has to be connected to GND                |

### 3 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 $V_{IN} + 0.3$<br>(7 V max.) | V    |
| EN        | Enable pin                           | -0.3 to $V_{IN} + 0.3$<br>(7 V max.) | V    |
| PG        | Power Good pin                       | -0.3 to 7                            | V    |
| ADJ       | Adjust pin                           | 4                                    | V    |
| $I_{OUT}$ | Output current                       | Internally limited                   |      |
| $P_D$     | Power dissipation                    | Internally limited                   |      |
| $T_{STG}$ | Storage temperature range            | - 65 to 150                          | °C   |
| $T_{OP}$  | Operating junction temperature range | - 40 to 125                          | °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 | 55    | °C/W |
| $R_{thJC}$ | Thermal resistance junction-case    | 10    | °C/W |

**Table 4: ESD performance**

| Symbol | Parameter              | Test conditions | Value | Unit |
|--------|------------------------|-----------------|-------|------|
| ESD    | ESD protection voltage | HBM             | 4     | kV   |
|        |                        | MM              | 0.4   | kV   |

## 4 Electrical characteristics

$T_J = 25\text{ °C}$ ,  $V_{IN} = 1.8\text{ V}$ ,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ ,  $I_{OUT} = 100\text{ mA}$ ,  $V_{EN} = V_{IN}$ , unless otherwise specified.

Table 5: LD39100 electrical characteristics (adjustable version)

| Symbol           | Parameter                                     | Test conditions   | Min. | Typ.  | Max. | Unit                |
|------------------|---|---|------|-------|------|---------------------|
| $V_{IN}$         | Operating input voltage                       |   | 1.5  |       | 5.5  | V                   |
| $V_{ADJ}$        | $V_{ADJ}$ accuracy                            | $I_{OUT} = 10\text{ mA}$<br>$T_J = 25\text{ °C}$  | 784  | 800   | 816  | mV                  |
|                  |   | $I_{OUT} = 10\text{ mA}$<br>$-40\text{ °C} < T_J < 125\text{ °C}$   | 776  | 800   | 824  |                     |
| $I_{ADJ}$        | Adjust pin current                            |   |      |       | 1    | $\mu\text{A}$       |
| $\Delta V_{OUT}$ | Static line regulation                        | $V_{OUT} + 1\text{ V} \leq V_{IN} \leq 5.5\text{ V}$<br>$I_{OUT} = 100\text{ mA}$   |      | 0.01  |      | %/V                 |
| $\Delta V_{OUT}$ | Transient line regulation <sup>(1)</sup>      | $\Delta V_{IN} = 500\text{ mV}$<br>$I_{OUT} = 100\text{ mA}$<br>$t_R = 5\text{ }\mu\text{s}$                              |      | 10    |      | mVpp                |
|                  |   | $\Delta V_{IN} = 500\text{ mV}$<br>$I_{OUT} = 100\text{ mA}$<br>$t_F = 5\text{ }\mu\text{s}$                              |      | 10    |      |                     |
| $\Delta V_{OUT}$ | Static load regulation                        | $I_{OUT} = 10\text{ mA}$ to 1 A   |      | 0.002 |      | %/mA                |
| $\Delta V_{OUT}$ | Transient load regulation <sup>(1)</sup>      | $I_{OUT} = 10\text{ mA}$ to 1 A<br>$t_R = 5\text{ }\mu\text{s}$   |      | 40    |      | mVpp                |
|                  |   | $I_{OUT} = 1\text{ A}$ to 10 mA<br>$t_F = 5\text{ }\mu\text{s}$   |      | 40    |      |                     |
| $V_{DROP}$       | Dropout voltage <sup>(2)</sup>                | $I_{OUT} = 1\text{ A}$ $V_O$ fixed to 1.5 V<br>$-40\text{ °C} < T_J < 125\text{ °C}$                                      |      | 200   | 400  | mV                  |
| $e_N$            | Output noise voltage                          | 10 Hz to 100 kHz<br>$I_{OUT} = 100\text{ mA}$<br>$V_{OUT} = 0.8\text{ V}$   |      | 30    |      | $\mu\text{V}_{RMS}$ |
| SVR              | Supply voltage rejection $V_O = 0.8\text{ V}$ | $V_{IN} = 1.8\text{ V} \pm V_{RIPPLE}$<br>$V_{RIPPLE} = 0.25\text{ V}$<br>frequency = 1 kHz<br>$I_{OUT} = 10\text{ mA}$   |      | 70    |      | dB                  |
|                  |   | $V_{IN} = 1.8\text{ V} \pm V_{RIPPLE}$<br>$V_{RIPPLE} = 0.25\text{ V}$<br>frequency = 10 kHz<br>$I_{OUT} = 100\text{ mA}$ |      | 65    |      |                     |

| Symbol            | Parameter                     | Test conditions  | Min. | Typ.                      | Max. | Unit |
|-------------------|-------------------------------|--|------|---------------------------|------|------|
| I <sub>Q</sub>    | Quiescent current             | I <sub>OUT</sub> = 0 mA  |      | 20                        |      | μA   |
|                   |                               | I <sub>OUT</sub> = 0 mA<br>-40 °C < T <sub>J</sub> < 125 °C                            |      |                           | 50   |      |
|                   |                               | I <sub>OUT</sub> = 0 to 1 A  |      | 200                       |      |      |
|                   |                               | I <sub>OUT</sub> = 0 to 1 A<br>-40 °C < T <sub>J</sub> < 125 °C                        |      |                           | 300  |      |
|                   |                               | V <sub>IN</sub> input current in off mode:<br>V <sub>EN</sub> = GND <sup>(3)</sup>     |      | 0.001                     | 1    |      |
| PG                | Power good output threshold   | Rising edge  |      | 0.92*<br>V <sub>OUT</sub> |      | V    |
|                   |                               | Falling edge   |      | 0.8*<br>V <sub>OUT</sub>  |      |      |
|                   | Power good output voltage low | I <sub>sink</sub> = 6 mA open drain output   |      |                           | 0.4  | V    |
| I <sub>SC</sub>   | Short-circuit current         | R <sub>L</sub> = 0   |      | 1.5                       |      | A    |
| V <sub>EN</sub>   | Enable input logic low        | V <sub>IN</sub> = 1.5 V to 5.5 V<br>-40 °C < T <sub>J</sub> < 125 °C                   |      |                           | 0.4  | V    |
|                   | Enable input logic high       |  | 0.9  |                           |      | V    |
| I <sub>EN</sub>   | Enable pin input current      | V <sub>EN</sub> = V <sub>IN</sub>  |      | 0.1                       | 100  | nA   |
| t <sub>ON</sub>   | Turn-on time <sup>(4)</sup>   |  |      | 30                        |      | μs   |
| T <sub>SHDN</sub> | Thermal shutdown              |  |      | 160                       |      | °C   |
|                   | Hysteresis                    |  |      | 20                        |      |      |
| C <sub>OUT</sub>  | Output capacitor              | Capacitance<br>(see <a href="#">Section 5: "Typical performance characteristics"</a> ) | 1    |                           |      | μF   |

**Notes:**

<sup>(1)</sup>All transient values are guaranteed by design, not tested in production.

<sup>(2)</sup>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.

<sup>(3)</sup>PG pin floating.

<sup>(4)</sup>Turn-on time is 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.

$T_J = 25\text{ }^\circ\text{C}$ ,  $V_{IN} = V_{OUT(NOM)} + 1\text{ V}$ ,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ ,  $I_{OUT} = 100\text{ mA}$ ,  $V_{EN} = V_{IN}$ , unless otherwise specified.

Table 6: LD39100 electrical characteristics (fixed version)

| Symbol           | Parameter  | Test conditions   | Min. | Typ.     | Max. | Unit                |
|------------------|--|---|------|----------|------|---------------------|
| $V_I$            | Operating input voltage                              |   | 1.5  |          | 5.5  | V                   |
| $V_{OUT}$        | $V_{OUT}$ accuracy                                   | $V_{OUT} > 1.5\text{ V}$ ,<br>$I_{OUT} = 10\text{ mA}$<br>$T_J = 25\text{ }^\circ\text{C}$  | -2.0 |          | 2.0  | %                   |
|                  |  | $V_{OUT} > 1.5\text{ V}$ ,<br>$I_{OUT} = 10\text{ mA}$<br>$-40\text{ }^\circ\text{C} < T_J < 125\text{ }^\circ\text{C}$                 | -3.0 |          | 3.0  |                     |
|                  |  | $V_{OUT} \leq 1.5\text{ V}$<br>$I_{OUT} = 10\text{ mA}$   |      | $\pm 20$ |      | mV                  |
|                  |  | $V_{OUT} \leq 1.5\text{ V}$<br>$I_{OUT} = 10\text{ mA}$<br>$-40\text{ }^\circ\text{C} < T_J < 125\text{ }^\circ\text{C}$                |      | $\pm 30$ |      |                     |
| $\Delta V_{OUT}$ | Static line regulation                               | $V_{OUT} + 1\text{ V} \leq V_{IN} \leq 5.5\text{ V}$<br>$I_{OUT} = 100\text{ mA}$   |      | 0.01     |      | %/V                 |
| $\Delta V_{OUT}$ | Transient line regulation <sup>(1)</sup>             | $\Delta V_{IN} = 500\text{ mV}$<br>$I_{OUT} = 100\text{ mA}$<br>$t_R = 5\text{ }\mu\text{s}$  |      | 10       |      | mVpp                |
|                  |  | $\Delta V_{IN} = 500\text{ mV}$<br>$I_{OUT} = 100\text{ mA}$<br>$t_F = 5\text{ }\mu\text{s}$  |      | 10       |      |                     |
| $\Delta V_{OUT}$ | Static load regulation                               | $I_{OUT} = 10\text{ mA to } 1\text{ A}$   |      | 0.002    |      | %/mA                |
| $\Delta V_{OUT}$ | Transient load regulation <sup>(1)</sup>             | $I_{OUT} = 10\text{ mA to } 1\text{ A}$<br>$t_R = 5\text{ }\mu\text{s}$   |      | 40       |      | mVpp                |
|                  |  | $I_{OUT} = 1\text{ A to } 10\text{ mA}$<br>$t_F = 5\text{ }\mu\text{s}$   |      | 40       |      |                     |
| $V_{DROP}$       | Dropout voltage <sup>(2)</sup>                       | $I_{OUT} = 1\text{ A}$ $V_{OUT} > 1.5\text{ V}$<br>$-40\text{ }^\circ\text{C} < T_J < 125\text{ }^\circ\text{C}$                        |      | 200      | 400  | mV                  |
| $e_N$            | Output noise voltage                                 | 10 Hz to 100 kHz<br>$I_{OUT} = 100\text{ mA}$<br>$V_{OUT} = 2.5\text{ V}$   |      | 85       |      | $\mu\text{V}_{RMS}$ |
| SVR              | Supply voltage rejection<br>$V_{OUT} = 1.5\text{ V}$ | $V_{IN} = V_{OUT(NOM)} + 0.5\text{ V} \pm V_{RIPPLE}$<br>$V_{RIPPLE} = 0.1\text{ V}$<br>frequency = 1 kHz<br>$I_{OUT} = 10\text{ mA}$   |      | 65       |      | dB                  |
|                  |  | $V_{IN} = V_{OUT(NOM)} + 0.5\text{ V} \pm V_{RIPPLE}$<br>$V_{RIPPLE} = 0.1\text{ V}$<br>frequency = 10 kHz<br>$I_{OUT} = 100\text{ mA}$ |      | 62       |      |                     |



| Symbol            | Parameter                     | Test conditions  | Min. | Typ.                      | Max. | Unit |
|-------------------|-------------------------------|--|------|---------------------------|------|------|
| I <sub>Q</sub>    | Quiescent current             | I <sub>OUT</sub> = 0 mA  |      | 20                        |      | μA   |
|                   |                               | I <sub>OUT</sub> = 0 mA<br>-40 °C < T <sub>J</sub> < 125 °C                            |      |                           | 50   |      |
|                   |                               | I <sub>OUT</sub> = 0 to 1 A  |      | 200                       |      |      |
|                   |                               | I <sub>OUT</sub> = 0 to 1 A<br>-40 °C < T <sub>J</sub> < 125 °C                        |      |                           | 300  |      |
|                   |                               | V <sub>IN</sub> input current in OFF mode: <sup>(3)</sup><br>V <sub>EN</sub> = GND     |      | 0.001                     | 1    |      |
| PG                | Power good output threshold   | Rising edge  |      | 0.92*<br>V <sub>OUT</sub> |      | V    |
|                   |                               | Falling edge   |      | 0.8*<br>V <sub>OUT</sub>  |      |      |
|                   | Power good output voltage low | I <sub>sink</sub> = 6 mA open drain output   |      |                           | 0.4  | V    |
| I <sub>SC</sub>   | Short-circuit current         | R <sub>L</sub> = 0   |      | 1.5                       |      | A    |
| V <sub>EN</sub>   | Enable input logic low        | V <sub>IN</sub> = 1.5 V to 5.5 V<br>-40 °C < T <sub>J</sub> < 125 °C                   |      |                           | 0.4  | V    |
|                   | Enable input logic high       |  | 0.9  |                           |      | V    |
| I <sub>EN</sub>   | Enable pin input current      | V <sub>EN</sub> = V <sub>IN</sub>  |      | 0.1                       | 100  | nA   |
| T <sub>ON</sub>   | Turn-on time <sup>(4)</sup>   |  |      | 30                        |      | μs   |
| T <sub>SHDN</sub> | Thermal shutdown              |  |      | 160                       |      | °C   |
|                   | Hysteresis                    |  |      | 20                        |      |      |
| C <sub>OUT</sub>  | Output capacitor              | Capacitance<br>(see <a href="#">Section 5: "Typical performance characteristics"</a> ) | 1    |                           |      | μF   |

**Notes:**

<sup>(1)</sup>All transient values are guaranteed by design, not tested in production.

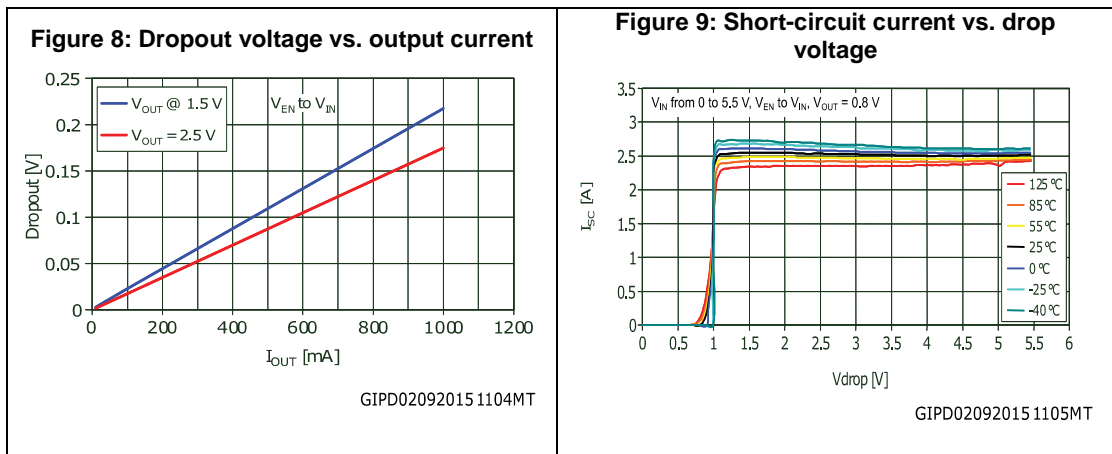
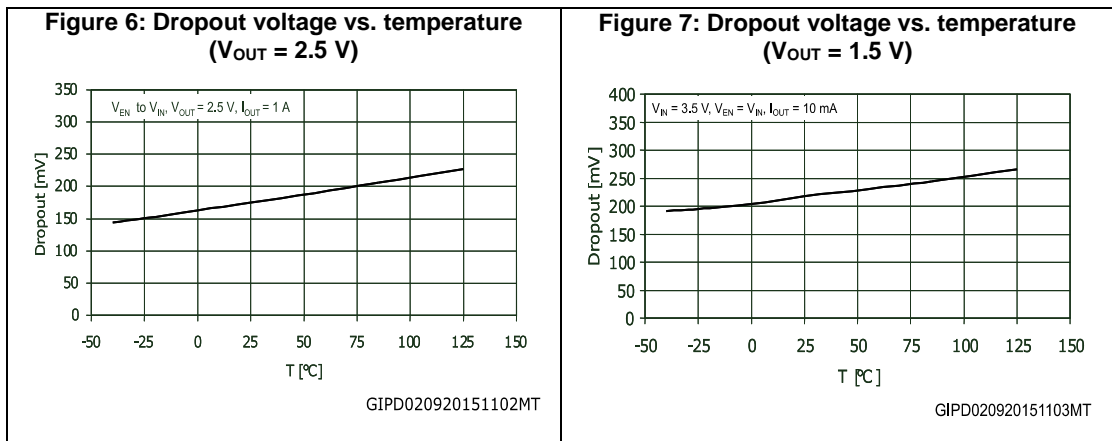
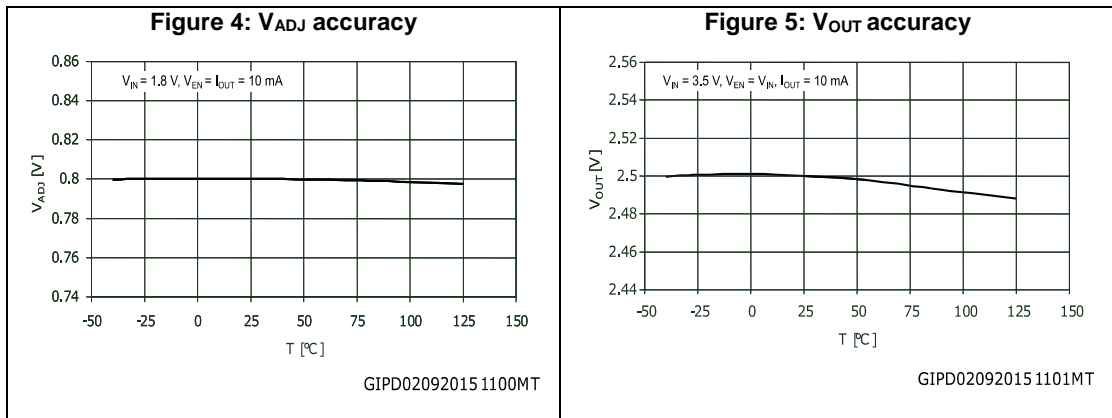
<sup>(2)</sup>Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value. This specification does not apply to output voltages below 1.5 V.

<sup>(3)</sup>PG pin floating.

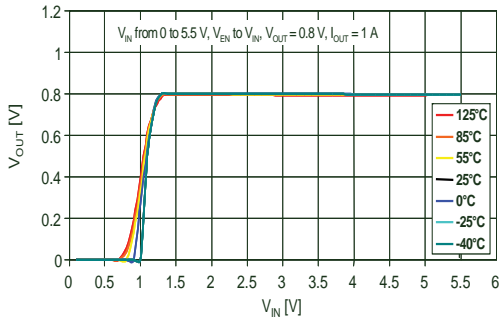
<sup>(4)</sup>Turn-on time is time measured between the enable input just exceeding V<sub>EN</sub> high value and the output voltage just reaching 95% of its nominal value.

# 5 Typical performance characteristics

$C_{IN} = C_{OUT} = 1 \mu F$

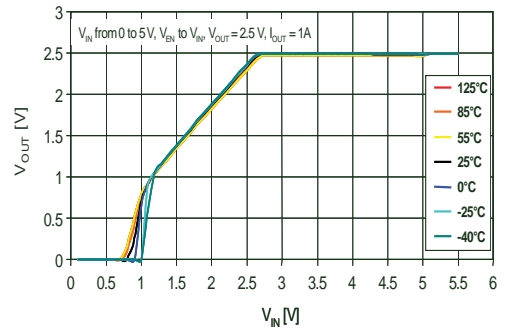


**Figure 10: Output voltage vs. input voltage (V<sub>OUT</sub> = 0.8 V)**



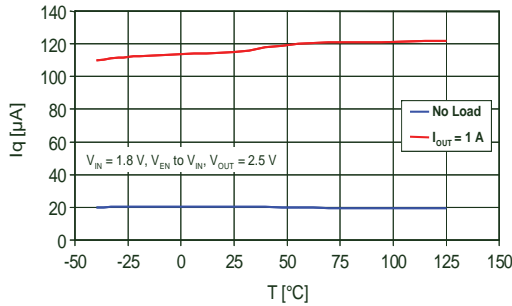
GIPD020920151106MT

**Figure 11: Output voltage vs. input voltage (V<sub>OUT</sub> = 2.5 V)**



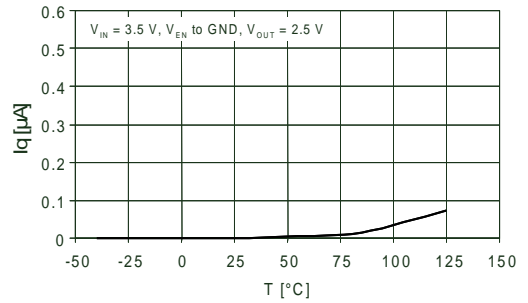
GIPD020920151107MT

**Figure 12: Quiescent current vs. temperature**



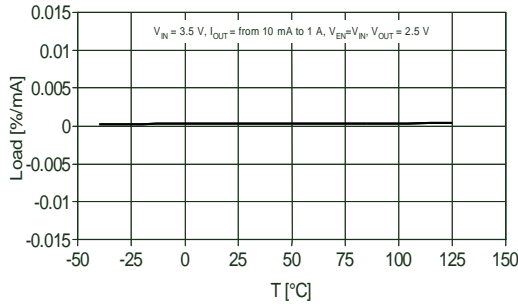
GIPD020920151108MT

**Figure 13: V<sub>IN</sub> input current in off mode vs. temperature**



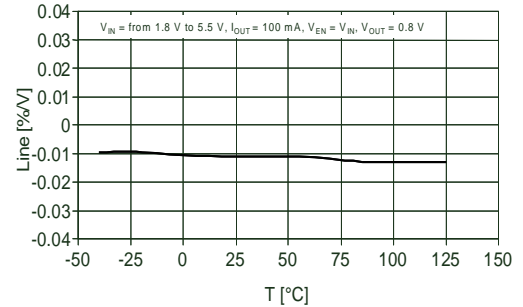
GIPD020920151109MT

**Figure 14: Load regulation**



GIPD020920151110MT

**Figure 15: Line regulation V<sub>OUT</sub> = 0.8 V**



GIPD020920151111MT

Figure 16: Line regulation  $V_{OUT} = 2.5\text{ V}$

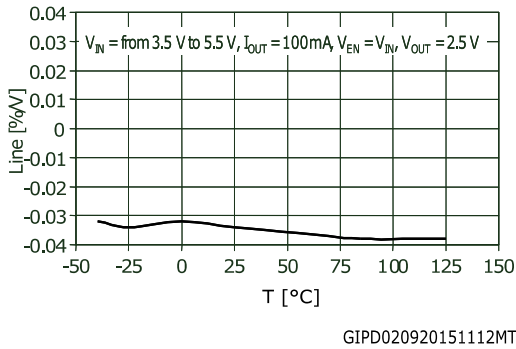


Figure 17: Supply voltage rejection vs. temperature ( $V_{OUT} = 0.8\text{ V}$ )

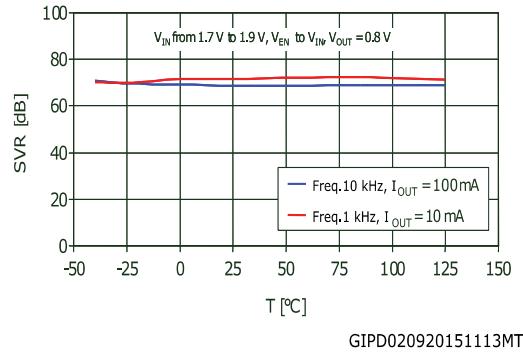


Figure 18: Supply voltage rejection vs. temperature ( $V_{OUT} = 2.5\text{ V}$ )

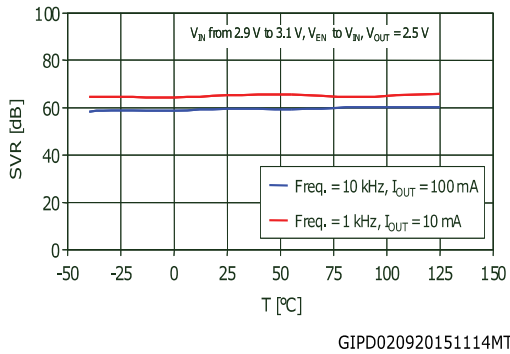


Figure 19: Supply voltage rejection vs. frequency ( $V_{OUT} = 0.8\text{ V}$ )

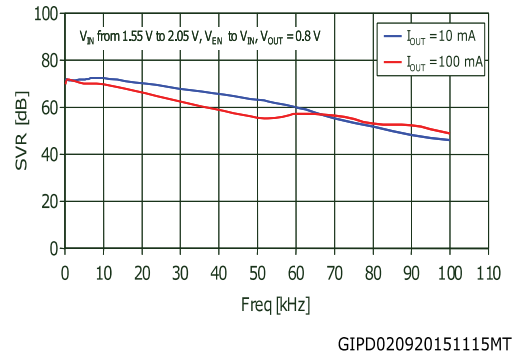


Figure 20: Supply voltage rejection vs. frequency ( $V_{OUT} = 2.5\text{ V}$ )

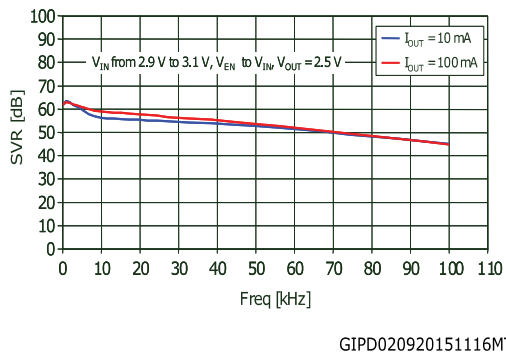


Figure 21: Output noise voltage vs. frequency

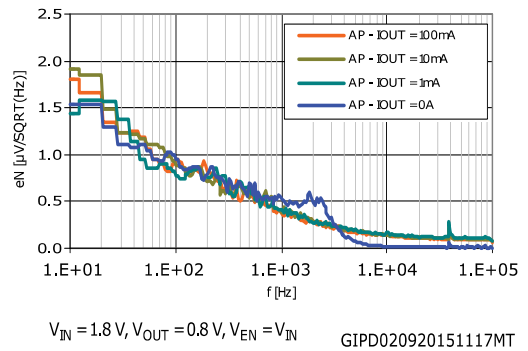


Figure 22: Enable voltage vs. temperature

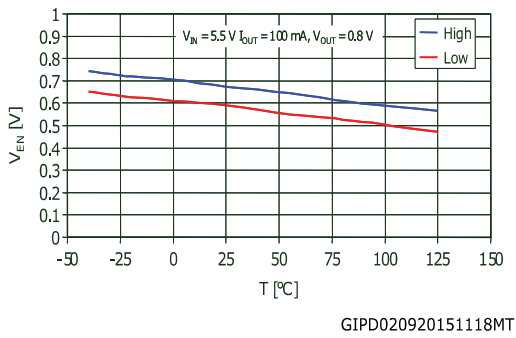
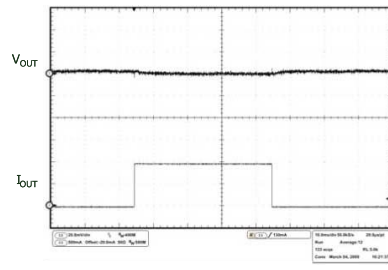


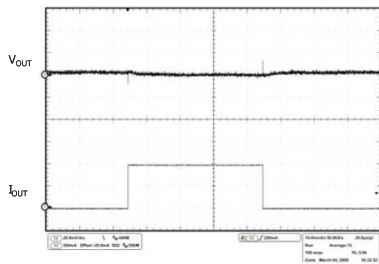
Figure 23: Load transient ( $I_{OUT}$  = from 10 mA to 1 A)



$V_{EN} = V_{IN} = 3.5\text{ V}$ ,  $V_{OUT} = 0.8\text{ V}$ ,  $I_{OUT}$  = from 10 mA to 1 A,  $t_R = t_F = 5\text{ }\mu\text{s}$

GIPD020920151119MT

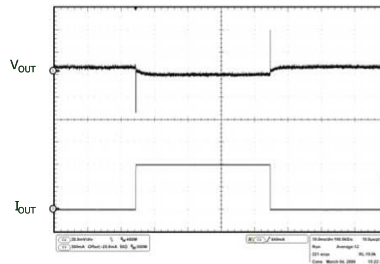
Figure 24: Load transient ( $V_{OUT} = 0.8\text{ V}$ )



$V_{EN} = V_{IN} = 3.5\text{ V}$ ,  $V_{OUT} = 0.8\text{ V}$ ,  $I_{OUT}$  = from 100 mA to 1 A,  $t_R = t_F = 5\text{ }\mu\text{s}$

GIPD020920151120MT

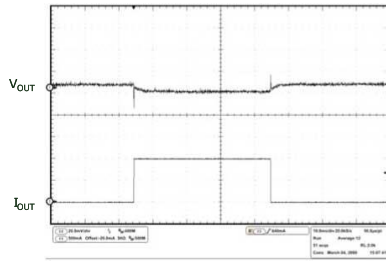
Figure 25: Load transient ( $V_{OUT} = 2.5\text{ V}$ )



$V_{EN} = V_{IN} = 3.5\text{ V}$ ,  $V_{OUT} = 2.5\text{ V}$ ,  $I_{OUT}$  = from 10 mA to 1 A,  $t_R = t_F = 5\text{ }\mu\text{s}$

GIPD020920151121MT

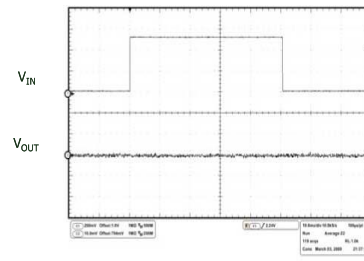
Figure 26: Load transient ( $I_{OUT}$  = from 100 mA to 1 A)



$V_{EN} = V_{IN} = 3.5\text{ V}$ ,  $V_{OUT} = 2.5\text{ V}$ ,  $I_{OUT}$  = from 100 mA to 1 A,  $t_R = t_F = 5\text{ }\mu\text{s}$

GIPD020920151122MT

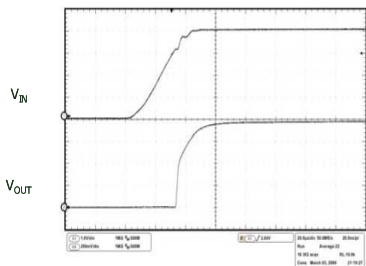
Figure 27: Line regulation transient



$V_{EN} = V_{IN} = 1.8\text{ V to }2.3\text{ V}$ ,  $V_{OUT} = 0.8\text{ V}$ ,  $I_{OUT} = 100\text{ mA}$ ,  $t_R = t_F = 5\text{ }\mu\text{s}$

GIPD040920151016MT

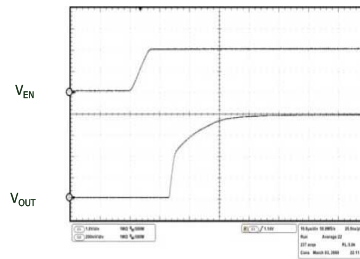
Figure 28: Start-up transient



$V_{EN} = V_{IN} = \text{from } 0.8 \text{ V}$ ,  $V_{OUT} = 0.8 \text{ V}$ ,  $I_{OUT} = 100 \text{ mA}$

GIPD040920151220MT

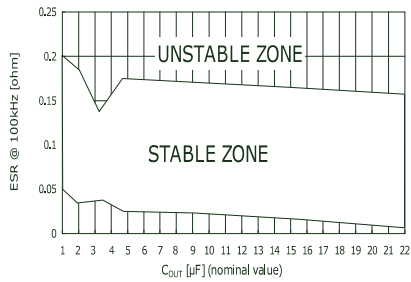
Figure 29: Enable transient



$V_{EN} = 0 \text{ to } 2 \text{ V}$ ,  $V_{OUT} = 0.8 \text{ V}$ ,  $V_{IN} = 3.5 \text{ V}$ ,  $I_{OUT} = 100 \text{ mA}$ ,  $t_r = t_f = 5 \mu\text{s}$

GIPD040920151221MT

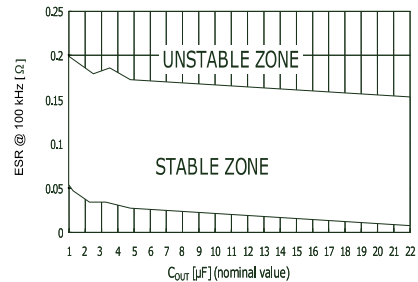
Figure 30: ESR required for stability with ceramic capacitors ( $V_{OUT} = 0.8 \text{ V}$ )



$V_{IN} = V_{EN} = \text{from } 1.5 \text{ V to } 5.5 \text{ V}$ ,  $V_{OUT} = 0.8 \text{ V}$ ,  $I_{OUT} = \text{from } 1 \text{ mA to } 1 \text{ A}$

GIPD040920151222MT

Figure 31: ESR required for stability with ceramic capacitors ( $V_{OUT} = 2.5 \text{ V}$ )



$V_{IN} = V_{EN} = \text{from } 3.5 \text{ V to } 5.5 \text{ V}$ ,  $V_{OUT} = 2.5 \text{ V}$ ,  $I_{OUT} = \text{from } 1 \text{ mA to } 1 \text{ A}$

GIPD040920151223MT

## 6 Application information

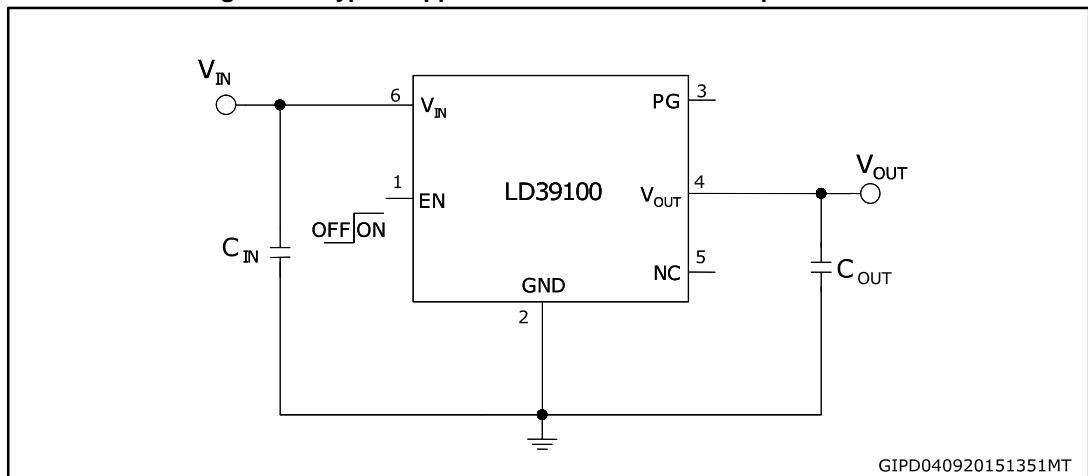
The LD39100 is an ultra low-dropout linear regulator. It provides up to 1 A with a low 200 mV dropout. The input voltage range is from 1.5 V to 5.5 V. The device is available in fixed and adjustable output versions.

The regulator is equipped with internal protection circuitry, such as short-circuit current limiting and thermal protection.

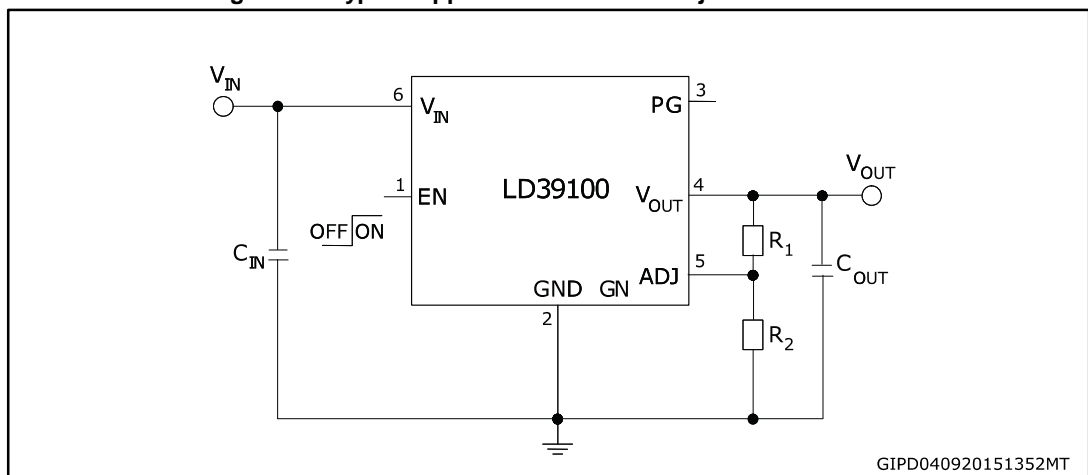
The regulator is stable with ceramic capacitors on the input and the output. Recommended values of the input and output ceramic capacitors are from 1  $\mu$ F to 22  $\mu$ F with 1  $\mu$ F typical. The input capacitor has to be connected within 1 cm from  $V_{IN}$  terminal. The output capacitor has also to be connected within 1 cm from output pin. There isn't any upper limit to the value of the input capacitor.

*Figure 32: "Typical application circuit for fixed output version" and Figure 33: "Typical application circuit for adjustable version" illustrate the typical application schematics:*

**Figure 32: Typical application circuit for fixed output version**



**Figure 33: Typical application circuit for adjustable version**



Regarding the adjustable version, the output voltage can be adjusted from 0.8 V up to the input voltage, minus the voltage drop across the pass element (dropout voltage), by connecting a resistor divider between ADJ pin and the output, thus allowing remote voltage sensing.

The resistor divider should be selected as follows:

**Equation 1**

$$V_{OUT} = V_{ADJ} (1 + R_1 / R_2) \text{ with } V_{ADJ} = 0.8 \text{ V (typ.)}$$

Resistors should be used with values in the range from 10 kΩ to 50 kΩ. Lower values can also be suitable, but they increase current consumption.

## 6.1 Power dissipation

An internal thermal feedback loop disables the output voltage if the die temperature rises to approximately 160 °C. This feature protects the device from excessive temperature and allows the user to push the limits of the power handling capability of a given circuit board without the risk of damaging the device.

A good PC board layout should be used to maximize power dissipation. The thermal path for the heat generated by the device is from the die to the copper lead frame, through the package leads and exposed pad, to the PC board copper. The PC board copper acts as a heatsink. The footprint copper pads should be as wide as possible to spread and dissipate the heat to the surrounding ambient. Feed-through vias to the inner or backside copper layers are also useful to improve the overall thermal performance of the device.

The device power dissipation depends on the input voltage, output voltage and output current, and is given by:

**Equation 2**

$$P_D = (V_{IN} - V_{OUT}) I_{OUT}$$

Junction temperature of the device is:

**Equation 3**

$$T_{J\_MAX} = T_A + R_{thJA} \times P_D$$

where:

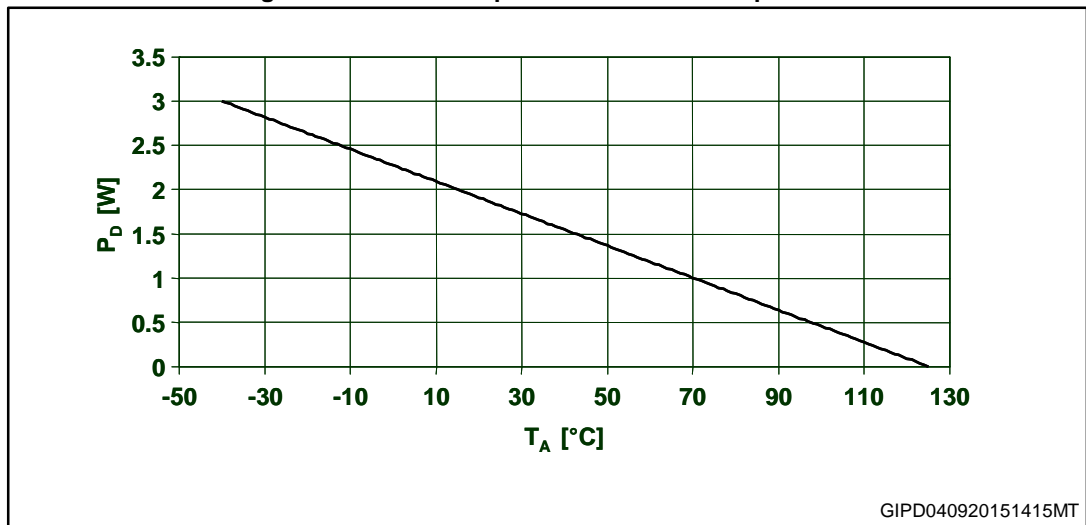
$T_{J\_MAX}$  is the maximum junction of the die, 125 °C

$T_A$  is the ambient temperature

$R_{thJA}$  is the thermal resistance junction-to-ambient



Figure 34: Power dissipation vs. ambient temperature



## 6.2 Enable function

The LD39100 features the enable function. When EN voltage is higher than 0.9 V, the device is ON, and if it is lower than 0.4 V, the device is OFF. In shutdown mode, consumption is lower than 1  $\mu$ A.

EN pin has not an internal pull-up, so it cannot be left floating if it is not used.

## 6.3 Power Good function

Some applications require a flag showing that the output voltage is in the correct range.

Power Good threshold depends on the adjust voltage. When it is higher than  $0.92 \cdot V_{ADJ}$ , Power Good (PG) pin goes to high impedance. If it is below  $0.80 \cdot V_{ADJ}$  PG pin goes to low impedance. If the device works well, Power Good pin is at high impedance. If the output voltage is fixed using an external or internal resistor divider, Power Good threshold is  $0.92 \cdot V_{OUT}$ .

If the device is disabled (EN pin low) the PG signal is set to high impedance. This is done intentionally to avoid pull down current by the PG pin in disabled mode.

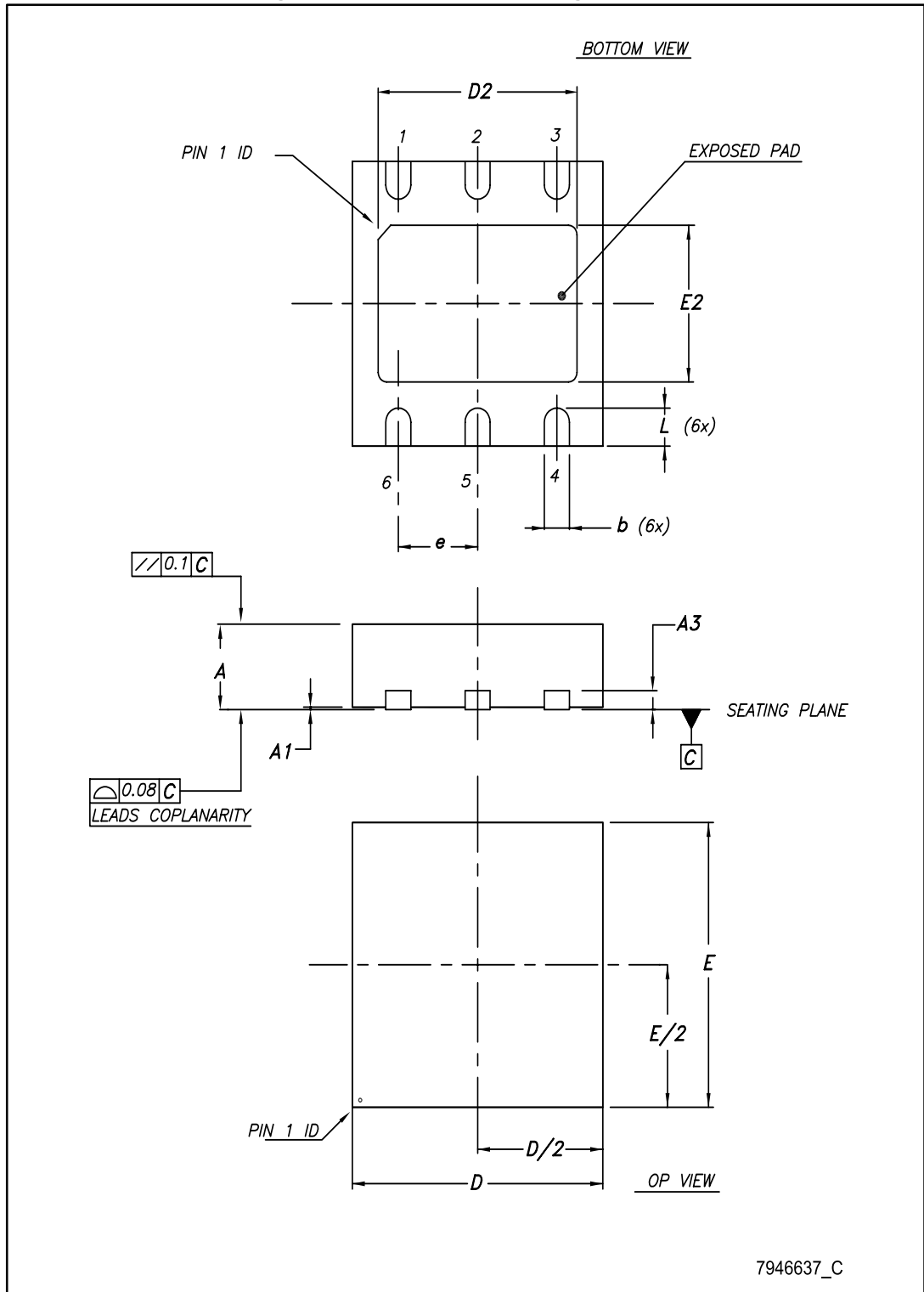
Power Good function requires an external pull-up resistor, which has to be connected between PG pin and  $V_{IN}$  or  $V_{OUT}$ . PG pin typical current capability is up to 6 mA. A pull-up resistor for PG should be in the range from 100 k $\Omega$  to 1 M $\Omega$ . If Power Good function is not used, PG pin has to remain floating.

## 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 DFN6 (3x3 mm) package information

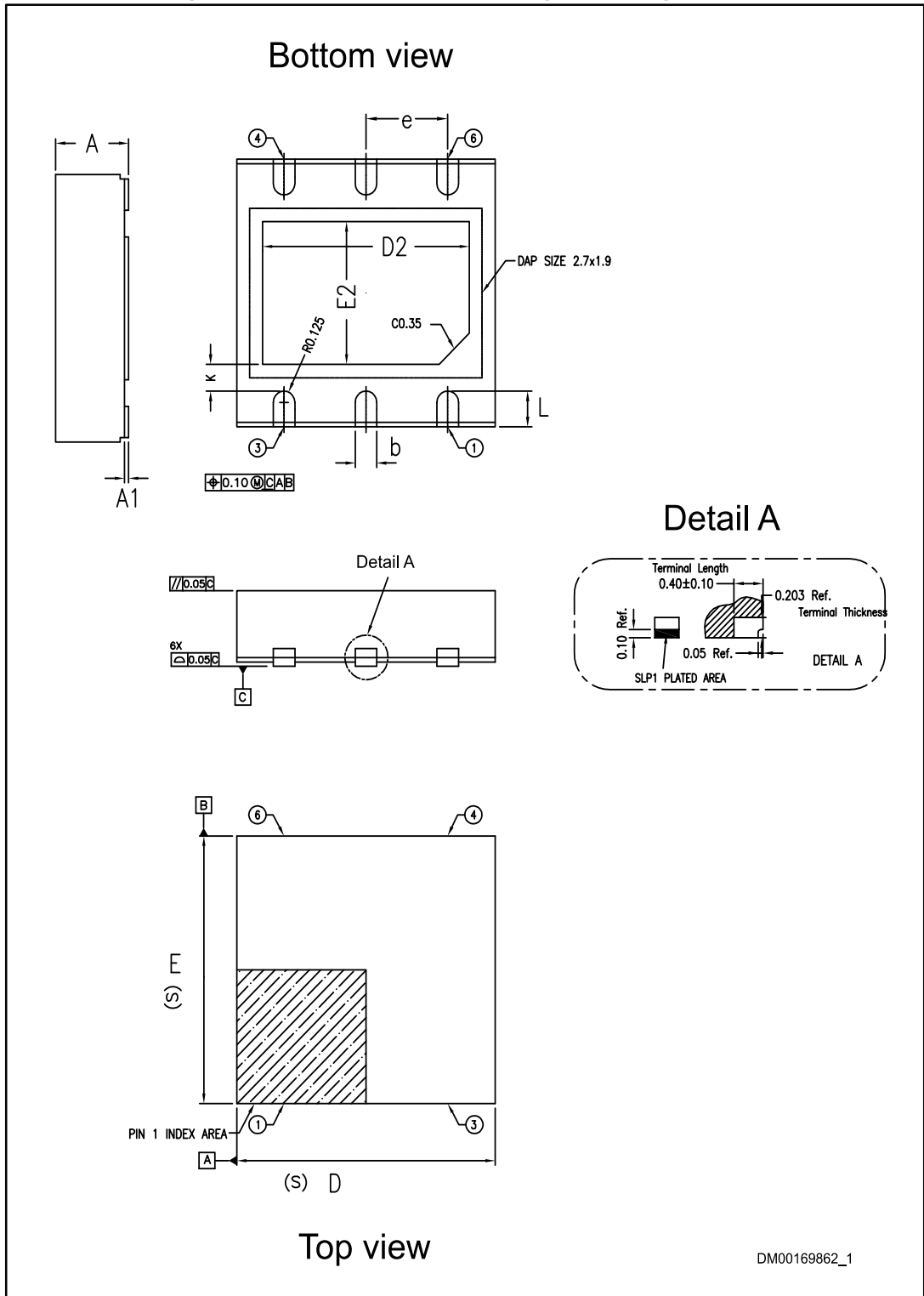
Figure 35: DFN6 (3x3 mm) package outline





### 7.2 DFN6 (3x3 mm) package information (automotive-grade)

Figure 37: DFN6 (3x3 mm) automotive-grade package outline

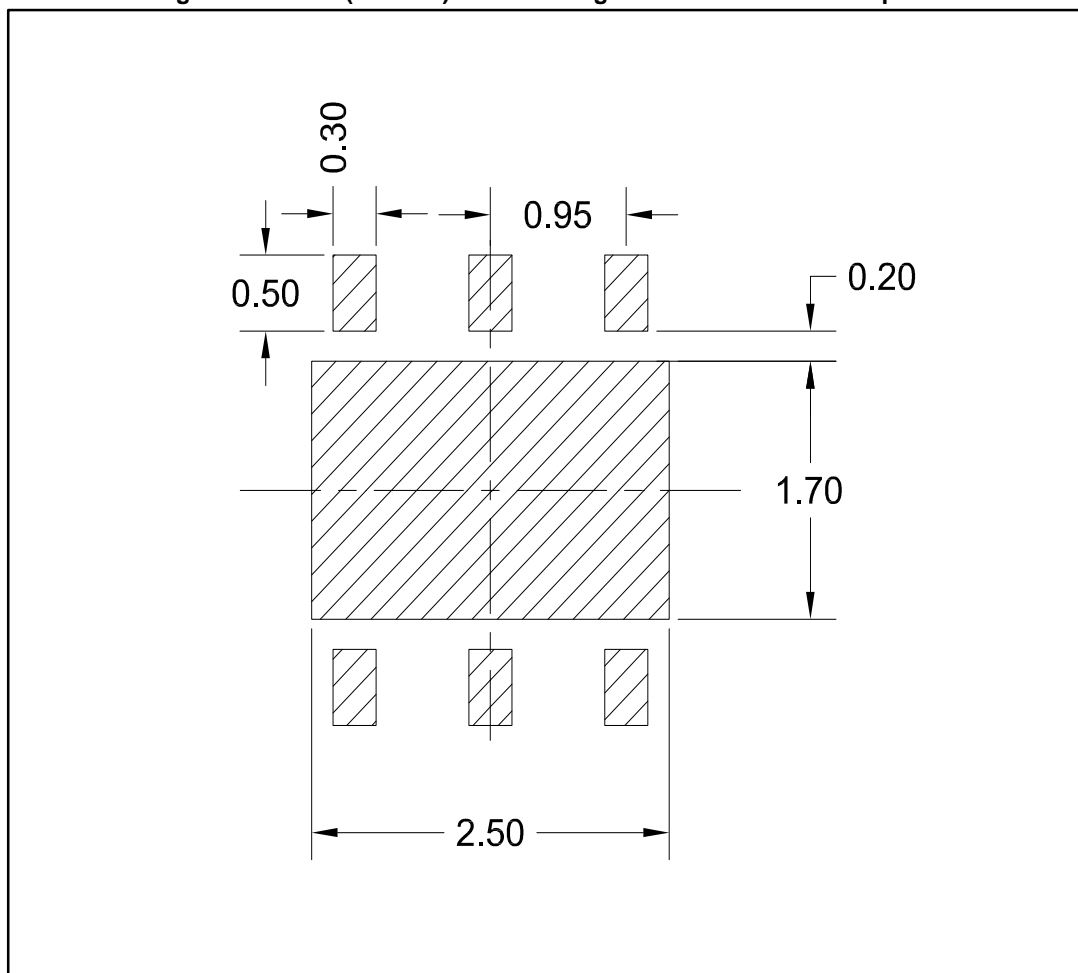


DM00169862\_1

Table 8: DFN6 (3x3 mm) automotive-grade mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    | 0.80 | 0.85 | 0.90 |
| A1   | 0.0  |      | 0.05 |
| b    | 0.20 | 0.25 | 0.30 |
| D    | 2.95 | 3.00 | 3.05 |
| D2   | 2.30 | 2.40 | 2.50 |
| e    | 0.95 |      |      |
| E    | 2.95 | 3.00 | 3.05 |
| E2   | 1.50 | 1.60 | 1.70 |
| L    | 0.30 | 0.40 | 0.50 |

Figure 38: DFN6 (3x3 mm) automotive-grade recommended footprint



### 7.3 DFN6 (3x3 mm) packing information

Figure 39: DFN6 (3x3 mm) tape outline

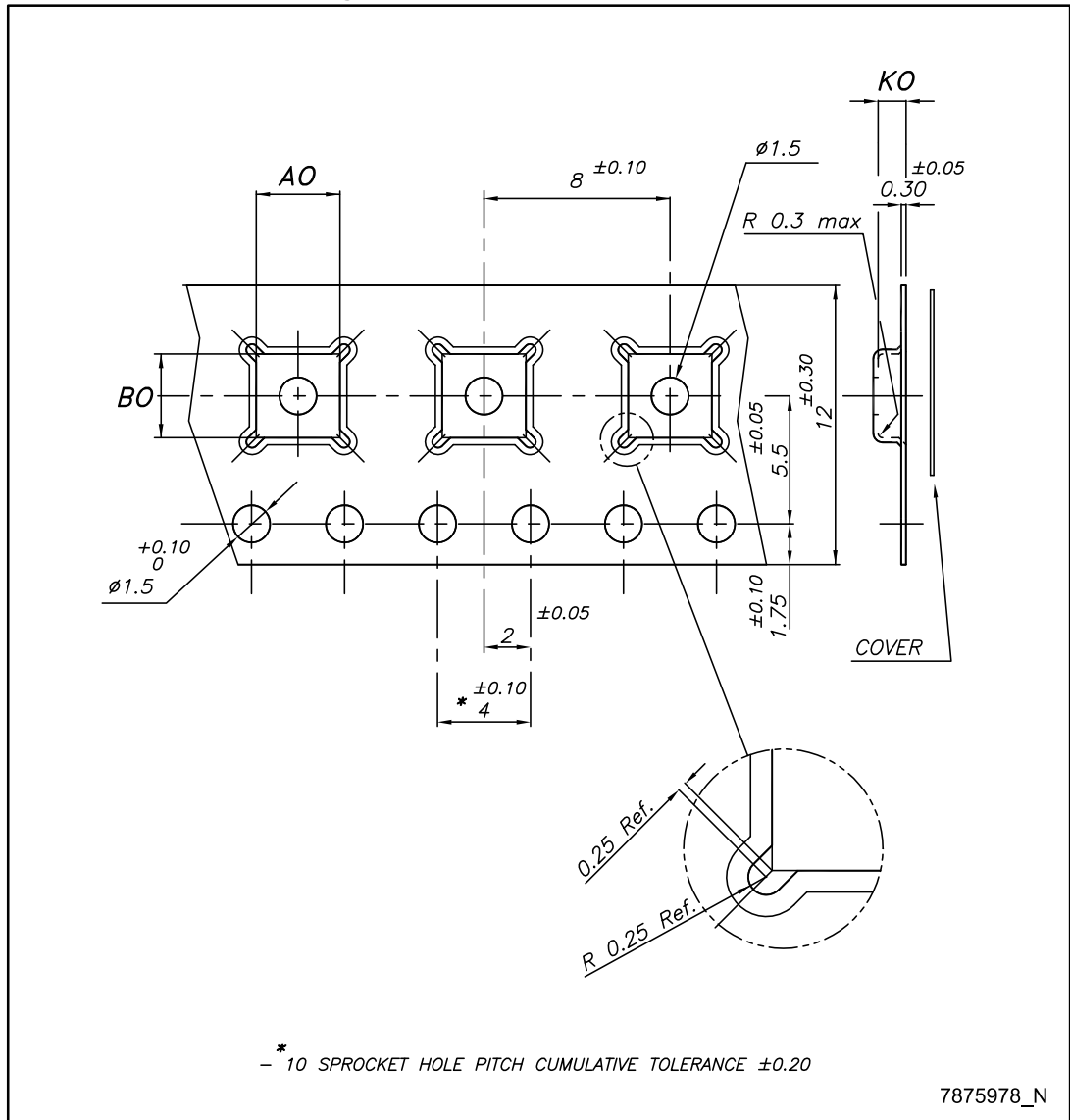


Figure 40: DFN6 (3x3 mm) reel outline

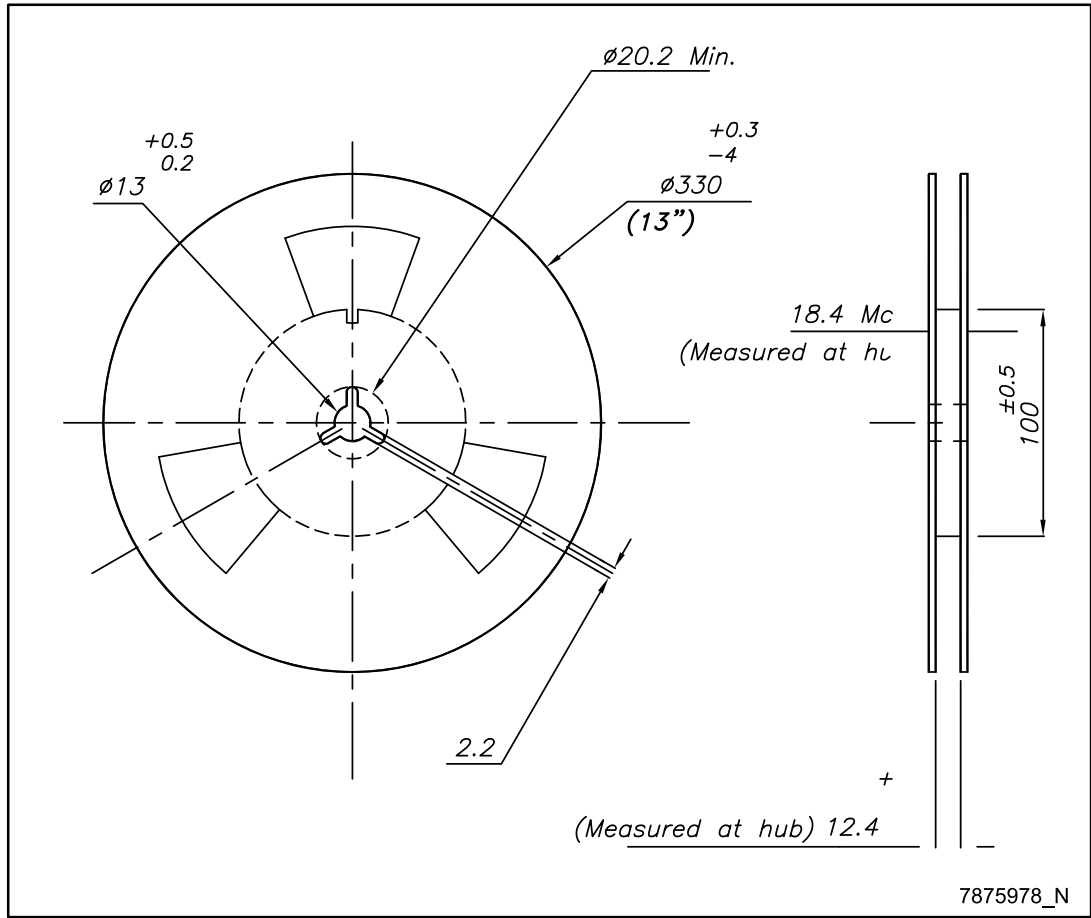


Table 9: DFN6 (3x3 mm) tape and reel mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A0   | 3.20 | 3.30 | 3.40 |
| B0   | 3.20 | 3.30 | 3.40 |
| K0   | 1    | 1.10 | 1.20 |



## 8 Ordering information

Table 10: Order code

| Order code       |                                 | Output voltage  |
|------------------|---------------------------------|-----------------|
| Industrial grade | Automotive grade <sup>(1)</sup> |                 |
| LD39100PUR       | LD39100PURY                     | Adj. from 0.8 V |
| LD39100PU12R     | LD39100PU12RY                   | 1.2 V           |
| LD39100PU18R     | LD39100PU18RY                   | 1.8 V           |
| LD39100PU25R     | LD39100PU25RY                   | 2.5 V           |
| LD39100PU30R     |                                 | 3.0 V           |
| LD39100PU33R     | LD39100PU33RY                   | 3.3 V           |

**Notes:**

<sup>(1)</sup>According to AEC-Q 100 level 1.

## 9 Revision history

**Table 11: Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 29-Jul-2009 | 1        | Initial release.   |
| 16-Apr-2010 | 2        | Modified Figure 8 on page 9.   |
| 11-Oct-2011 | 3        | Document status promoted from preliminary data to datasheet.   |
| 24-Apr-2014 | 4        | Part numbers LD39100xx, LD39100xx12 and LD39100xx25 changed to LD39100. Updated Table 1: Device summary. Updated the description in cover page Section 1: Circuit schematics, Section 2: Pin configuration, Section 4: Electrical characteristics, Section 5: Typical performance characteristics, Figure 32: Typical application circuit for fixed output version, Section 7: Package mechanical data. Deleted previous Section 8: Different output voltage versions of the LD39100xx available on request. Added Section 8: Packaging mechanical data. Minor text changes. |
| 01-Sep-2015 | 5        | Updated Figure 32: Typical application circuit for fixed output version. Minor text changes.   |
| 20-Jun-2016 | 6        | Updated features in cover page.<br>Removed Table 1: Device summary.<br>Updated <a href="#">Section 6.2: "Enable function"</a> .<br>Added <a href="#">Section 8: "Ordering information"</a> and <a href="#">Section 7.1: "DFN6 (3x3 mm) package information"</a> .<br>Minor text changes.   |

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2016 STMicroelectronics – All rights reserved