

## 300 mA low quiescent current soft-start, low noise voltage regulator

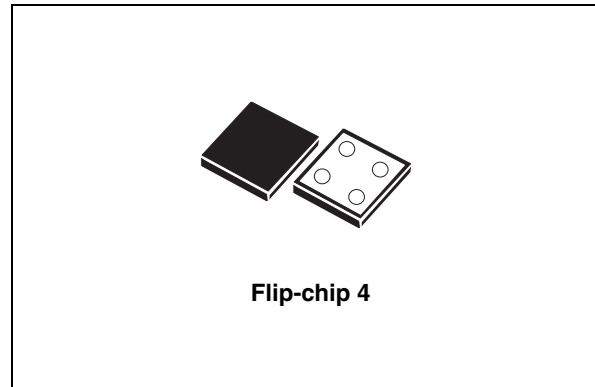
Datasheet – preliminary data

### Features

- Input voltage from 1.5 to 5.5 V
- Ultra low dropout voltage (200 mV typ. at 300 mA load)
- Very low quiescent current (20  $\mu$ A typ. at no load, 40  $\mu$ A typ. at 300 mA load, 1  $\mu$ A max. in off mode)
- Very low noise (33  $\mu$ V<sub>RMS</sub> from 1 kHz to 100 kHz at V<sub>OUT</sub> = 1.8 V)
- Output voltage tolerance:  $\pm$  2.0 % @ 25 °C
- 300 mA guaranteed output current
- Wide range of output voltages available on request: 0.8 V to 4.5 V with 100 mV step
- Logic-controlled electronic shutdown
- Compatible with ceramic capacitor C<sub>OUT</sub> = 1  $\mu$ F
- Internal current and thermal limit
- Flip-chip 4 bumps 0.8 x 0.8 mm pitch 0.4 mm
- Internal soft-start (typ. 100  $\mu$ s)
- Temperature range: - 40 °C to 125 °C

### Applications

- Mobile phones
- Personal digital assistants (PDAs)
- Cordless phones and similar battery-powered systems
- Digital still cameras.



### Description

The LD39030SJxx is a low noise voltage regulator that provides 300 mA maximum current from an input voltage in the 1.5 V to 5.5 V range, with a typical dropout voltage of 200 mV. It is stabilized with a ceramic capacitor on the 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 typically 62 dB at low frequencies and starts to roll off at 10 kHz. An enable logic control function puts the LD39030SJxx in shutdown mode allowing a total current consumption lower than 1  $\mu$ A. The device also includes a short-circuit constant current limiting and thermal protection.

**Table 1. Device summary**

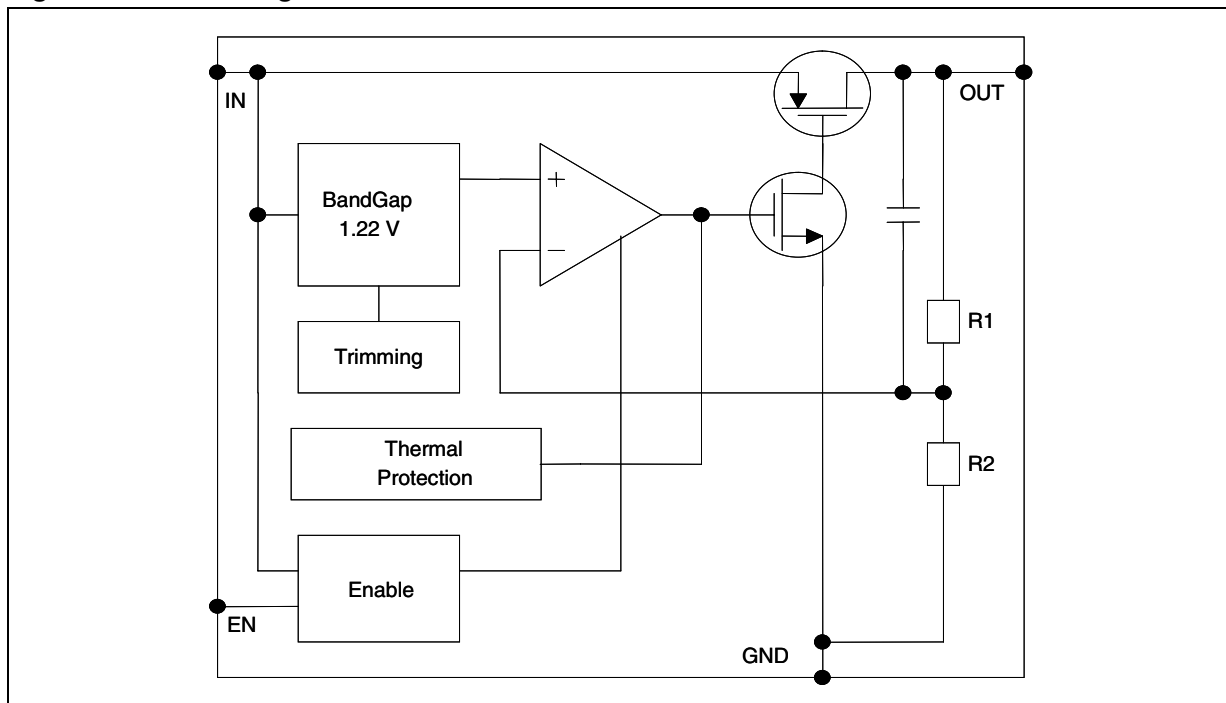
Part numbers	Order codes	Output voltages
LD39030SJXX12	LD39030SJ12R	1.2 V
LD39030SJXX33	LD39030SJ33R	3.3 V

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# 1 Block diagram

Figure 1. Block diagram



## 2 Pin configuration

Figure 2. Pin connection (top view)

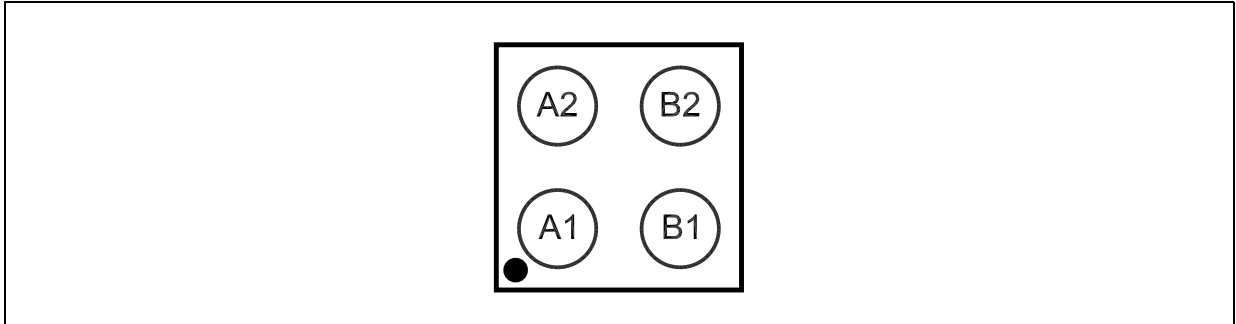
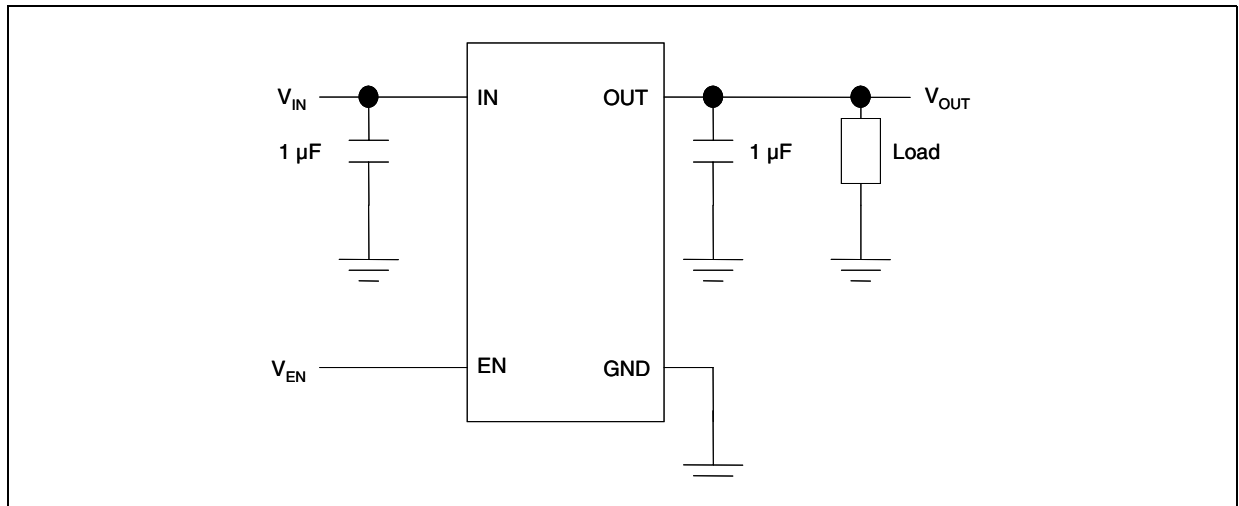


Table 2. Pin description

Pin n°	Symbol	Function
A2	EN	Enable pin logic input: low = shutdown, high = active
A1	GND	Common ground
B2	IN	Input voltage of the LDO
B1	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 6	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	Value	Unit
$R_{thJA}$	Thermal resistance junction-ambient	180	°C/W

## 5 Electrical characteristics

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

**Table 5. Electrical characteristics for LD39030SJ (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	$V_{OUT} > 1.5\text{ V}$ , $I_{OUT} = 1\text{ mA}$ , $T_J = 25\text{ °C}$	-2.0		2.0	%
		$V_{OUT} > 1.5\text{ V}$ , $I_{OUT} = 1\text{ mA}$ , $-40\text{ °C} < T_J < 125\text{ °C}$	-3.0		3.0	%
		$V_{OUT} \leq 1.5\text{ V}$ , $I_{OUT} = 1\text{ mA}$		$\pm 10$		mV
		$V_{OUT} \leq 1.5\text{ V}$ , $I_{OUT} = 1\text{ mA}$ , $-40\text{ °C} < T_J < 125\text{ °C}$		$\pm 30$		mV
$\Delta V_{OUT}$	Static line regulation	$V_{OUT} + 1\text{ V} \leq V_{IN} \leq 5.5\text{ V}$ , $I_{OUT} = 1\text{ mA}$		0.01		%/V
$\Delta V_{OUT}$	Transient line regulation (2)	$\Delta V_{IN} = +500\text{ mV}$ , $I_{OUT} = 1\text{ mA}$ , $T_R = T_F = 5\text{ }\mu\text{s}$		10		mVpp
$\Delta V_{OUT}$	Static load regulation	$I_{OUT} = 1\text{ mA}$ to $300\text{ mA}$		0.002		%/mA
$\Delta V_{OUT}$	Transient load regulation (2)	$I_{OUT} = 1\text{ mA}$ to $300\text{ mA}$ , $T_R = T_F = 5\text{ }\mu\text{s}$		40		mVpp
$V_{DROP}$	Dropout voltage (3)	$I_{OUT} = 300\text{ mA}$ , $V_{OUT} > 1.5\text{ V}$ , $-40\text{ °C} < T_J < 125\text{ °C}$		200		mV
$e_N$	Output noise voltage	10 Hz to 100 kHz, $I_{OUT} = 10\text{ mA}$		30		$\mu\text{V}_{RMS}/\text{V}$
SVR	Supply voltage rejection $V_{OUT} = 1.2\text{ V}$	$V_{IN} = V_{OUTNOM} + 1\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$ Freq. = 1 kHz $I_{OUT} = 10\text{ mA}$		62		dB
		$V_{IN} = V_{OUTNOM} + 0.5\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$ Freq. = 10 kHz $I_{OUT} = 10\text{ mA}$		62		
$I_Q$	Quiescent current	$I_{OUT} = 0\text{ mA}$		20		$\mu\text{A}$
		$I_{OUT} = 0\text{ mA}$ , $-40\text{ °C} < T_J < 125\text{ °C}$			50	
		$I_{OUT} = 0$ to $300\text{ mA}$		40		
		$I_{OUT} = 0$ to $300\text{ mA}$ , $-40\text{ °C} < T_J < 125\text{ °C}$			85	
		$V_{IN}$ input current in OFF MODE: $V_{EN} = \text{GND}$		0.001	1	
$I_{SC}$	Short-circuit current	$R_L = 0$	400			mA
$V_{EN}$	Enable input logic low	$V_{IN} = 1.5\text{ V}$ to $5.5\text{ V}$ , $-40\text{ °C} < T_J < 125\text{ °C}$			0.4	V
	Enable input logic high	$V_{IN} = 1.5\text{ V}$ to $5.5\text{ V}$ , $-40\text{ °C} < T_J < 125\text{ °C}$	0.9			

**Table 5. Electrical characteristics for LD39030SJ (continued)<sup>(1)</sup>**

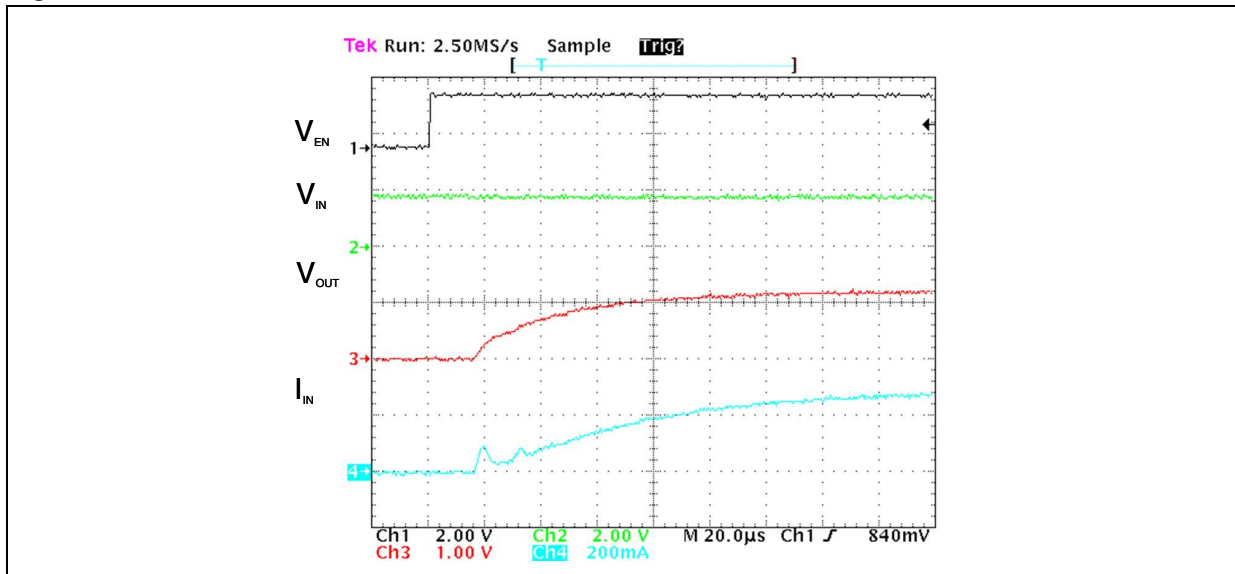
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{EN}$	Enable pin input current	$V_{SHDN}=V_{IN}$		0.1	100	nA
$T_{ON}$	Turn-on time <sup>(4)</sup>			100		$\mu$ s
$T_{SHDN}$	Thermal shutdown			160		°C
	Hysteresis			20		
$C_{OUT}$	Output capacitor	Capacitance (see <a href="#">Section 7: Typical performance characteristics</a> )	1		22	$\mu$ F

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 for output voltages below 1.5 V.
4. 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.

## 6 Soft-start function

The LD39030SJ has an internal soft-start circuit. By increasing the startup time up to 100  $\mu\text{s}$ , without the need of any external soft-start capacitor, this feature is able to reduce the regulator inrush current to 1/3 of the original value.

Figure 4. Soft-start function



$V_{IN} = 1.8 \text{ V}$ ,  $V_{EN} = 1.8 \text{ V}$ ,  $C_{IN} = 1 \mu\text{F}$ ,  $C_{OUT} = 1 \mu\text{F}$ .

# 7 Typical performance characteristics

$C_{IN} = C_{OUT} = 1 \mu F, V_{EN}$  to  $V_{IN}$ .

Figure 5. Output voltage vs. temperature

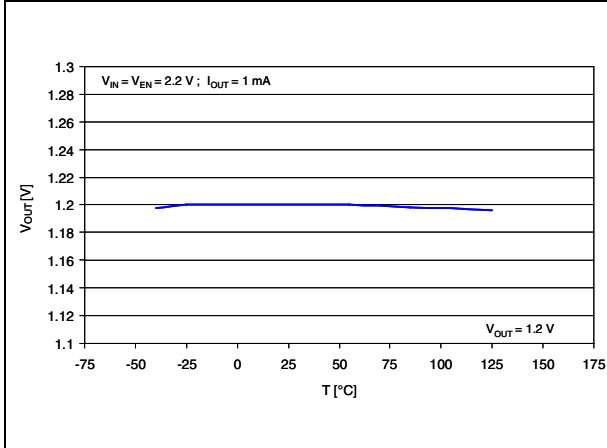


Figure 6. Output voltage vs. input voltage

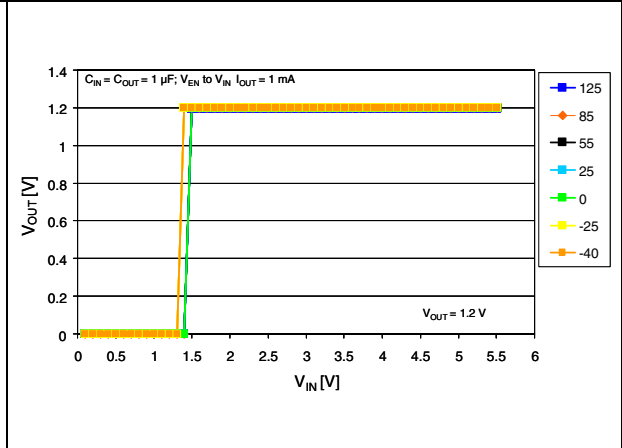


Figure 7. Line regulation vs. temperature

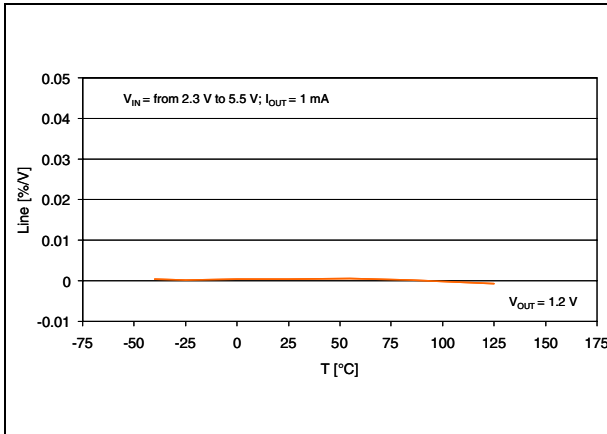


Figure 8. Load regulation vs. temperature

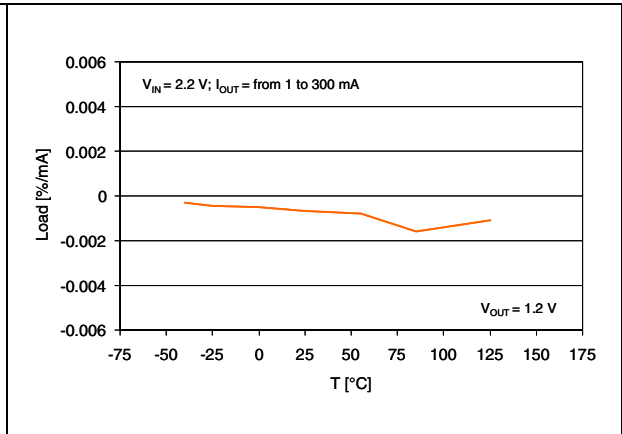


Figure 9. Short-circuit current vs. drop voltage

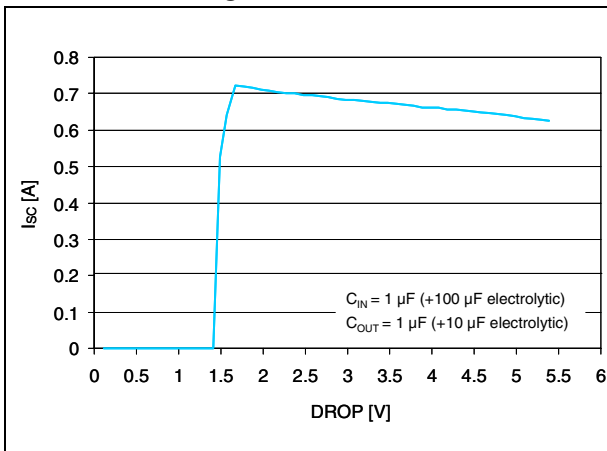


Figure 10. Quiescent current vs. input voltage

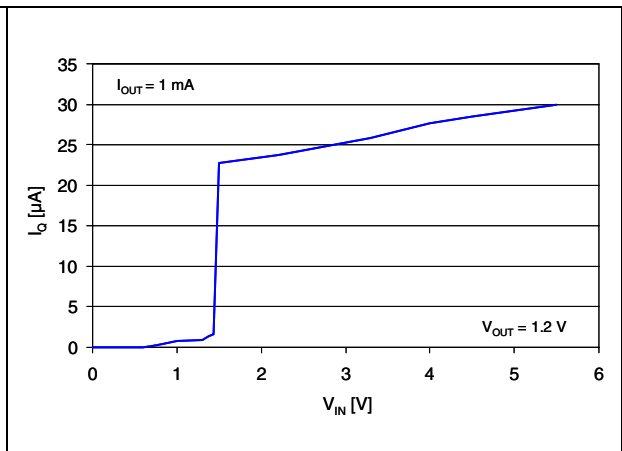


Figure 11. Enable threshold vs. temperature

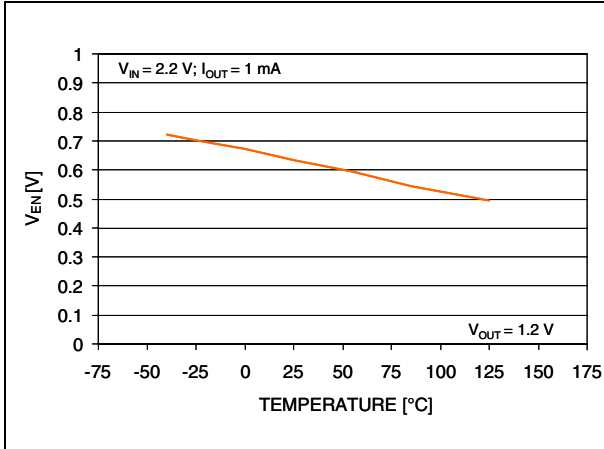


Figure 12. Quiescent current vs. temperature

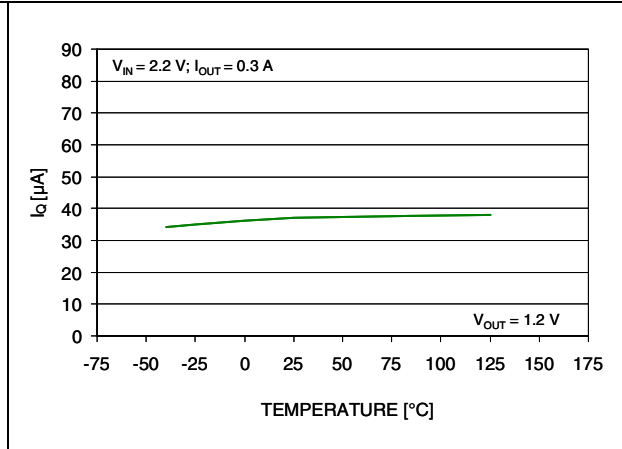


Figure 13. Supply voltage rejection vs. temperature

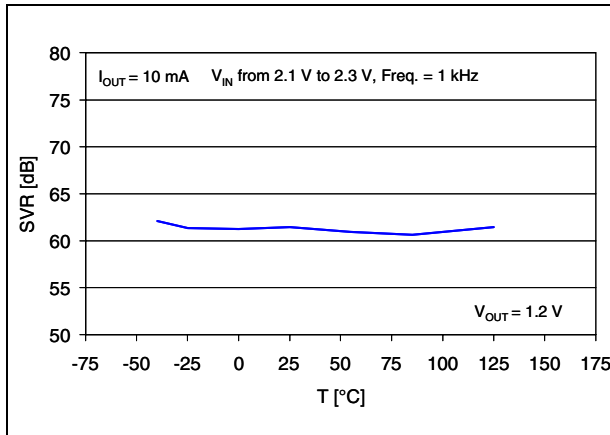


Figure 14. Supply voltage rejection vs. frequency

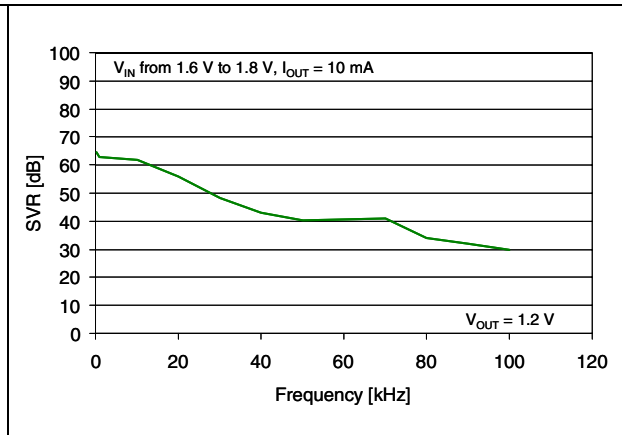


Figure 15. Supply voltage rejection vs. temperature

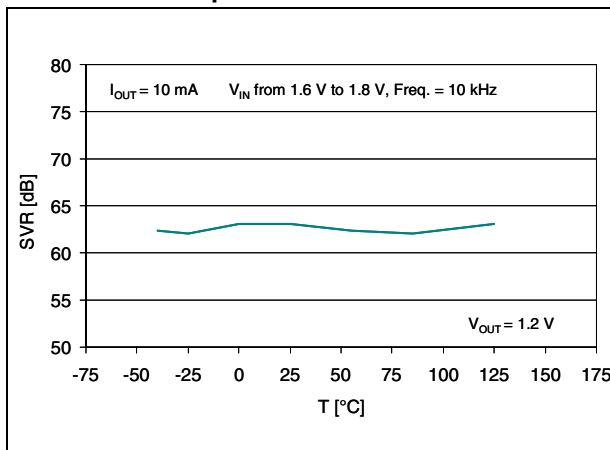


Figure 16. Supply voltage rejection vs. frequency

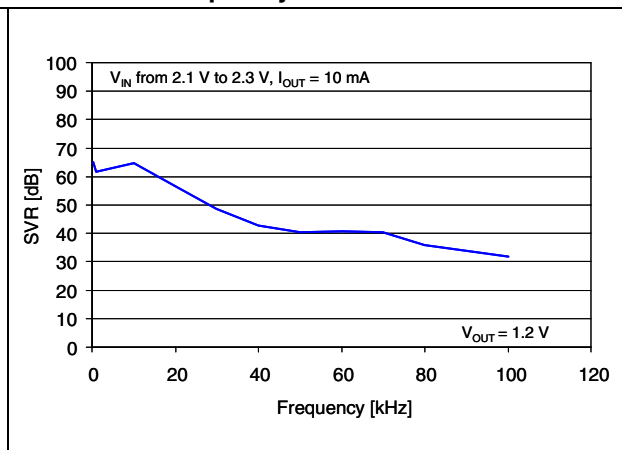


Figure 17. Line transient

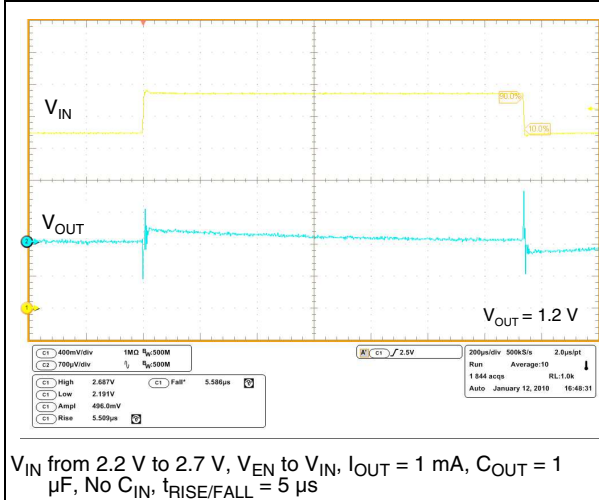


Figure 18. Load transient

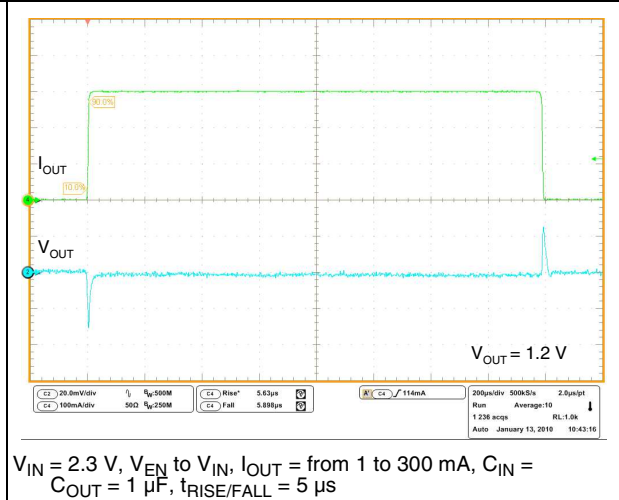


Figure 19. Enable transient

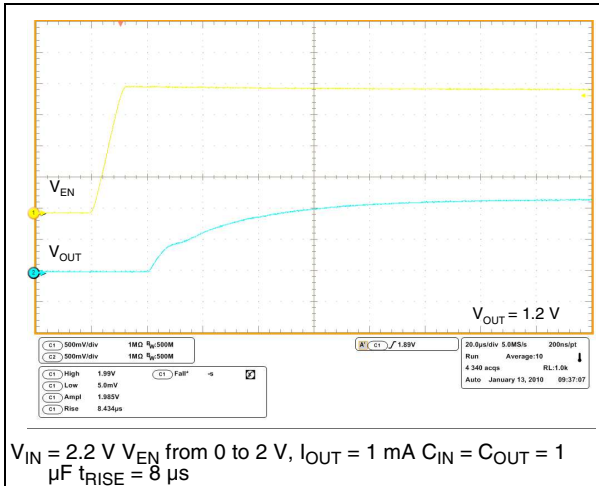


Figure 20. Startup transient

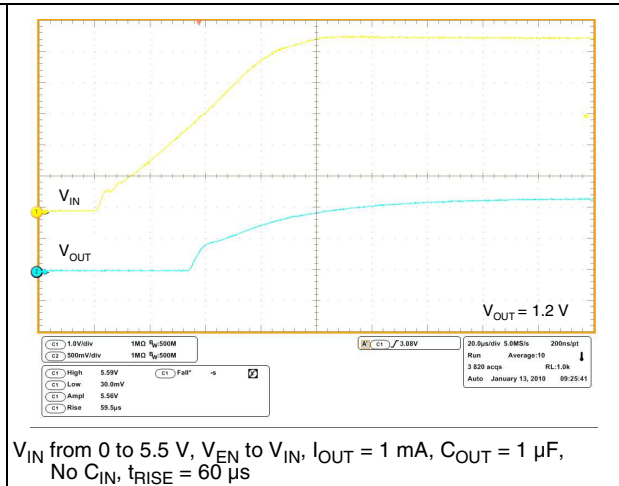
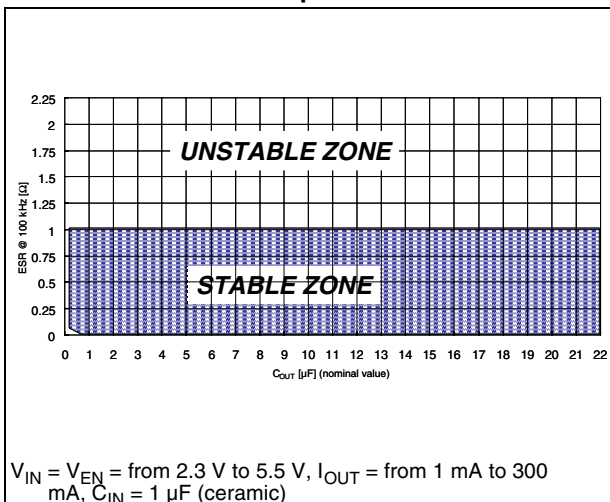


Figure 21. ESR required for stability with ceramic capacitors



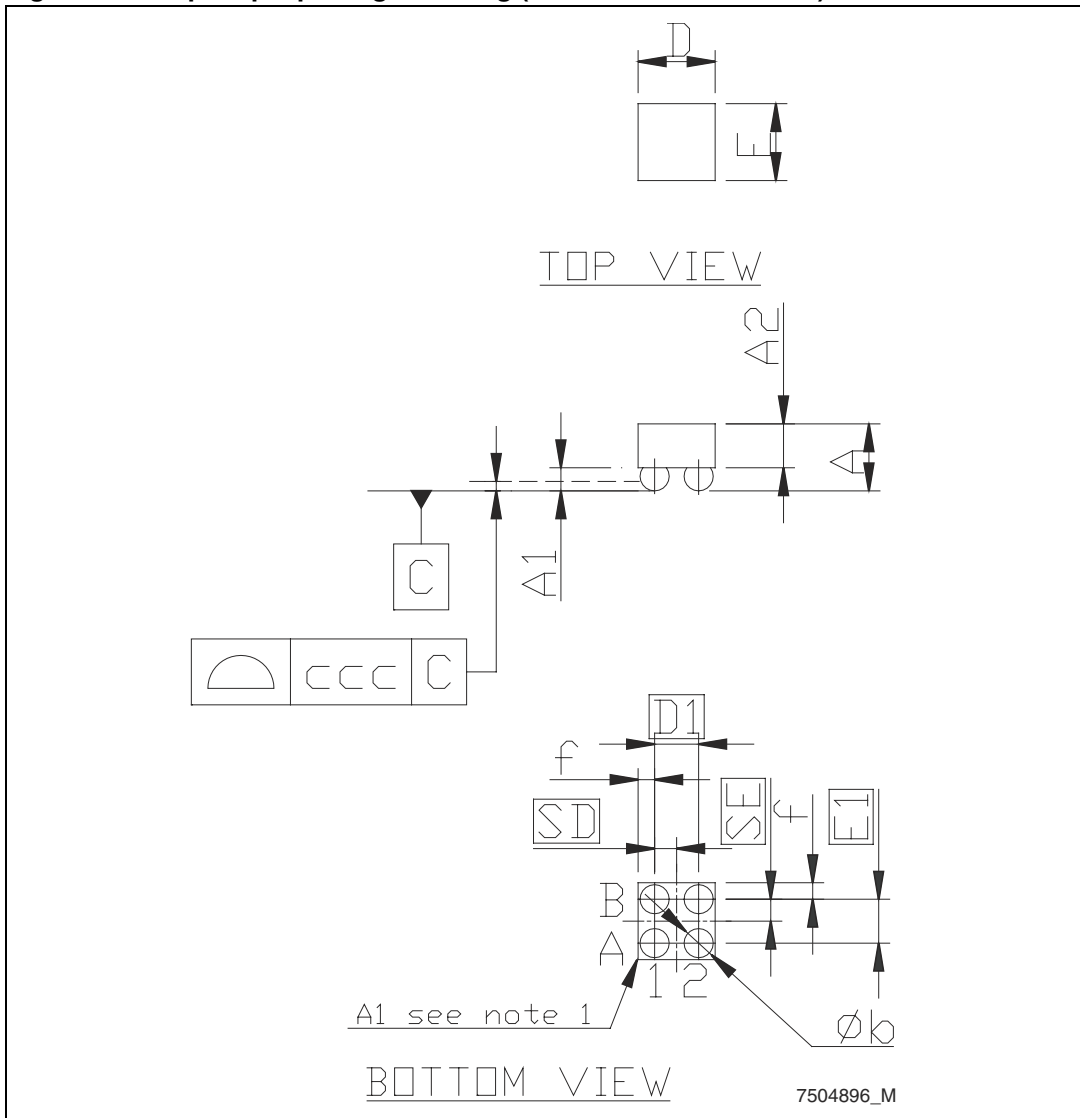
## 8 Package mechanical data

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

**Table 6. Flip-chip 4 package mechanical data**

Dim.	mm.		
	Min.	Typ.	Max.
A	0.52	0.56	0.60
A1	0.17	0.20	0.23
A2	0.35	0.36	0.37
b	0.23	0.25	0.29
D	0.758	0.788	0.818
D1		0.4	
E	0.758	0.788	0.818
E1		0.4	
SD	0.18	0.2	0.22
SE	0.18	0.2	0.22
f		0.199	
ccc		0.075	

Figure 22. Flip-chip 4 package drawing (dimensions are in mm.)



**Tape and reel Flip-chip 4 mechanical data**

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			178			6.926
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	59	60	61	2.323	2.362	2.401
T			8.4			0.331
Ao	0.82	0.87	0.92	0.032	0.034	0.036
Bo	0.82	0.87	0.92	0.032	0.034	0.036
Ko	0.64	0.69	0.74	0.025	0.027	0.029
Po	3.9	4	4.1	0.153	0.157	0.161
P	3.9	4	4.1	0.153	0.157	0.161

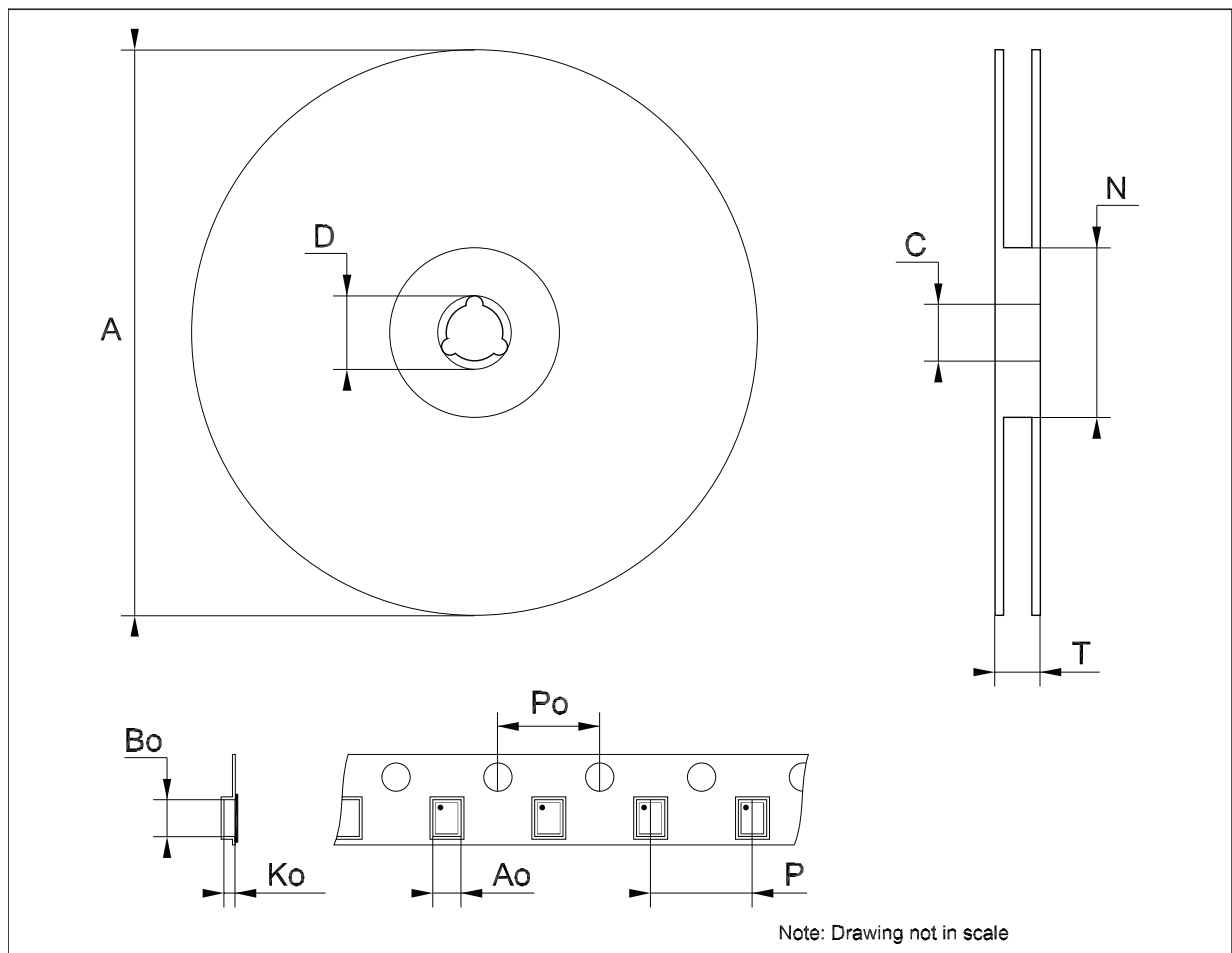
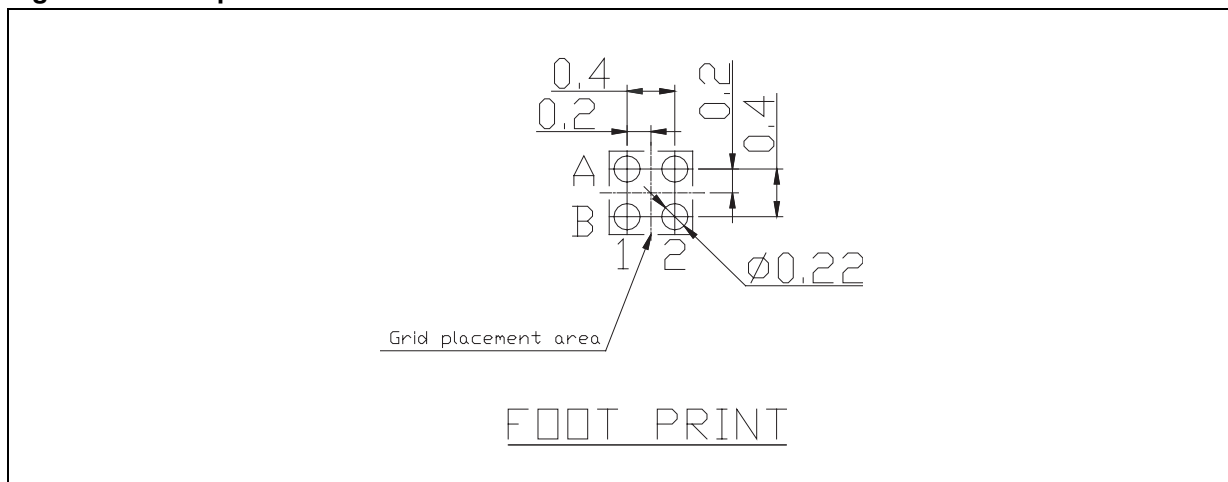


Figure 23. Footprint data



## 9 Revision history

**Table 7. Document revision history**

Date	Revision	Changes
14-Oct-2010	1	First release.
10-Jul-2012	2	Added: new order code LD39030SJ33R <a href="#">Table 1 on page 1</a> . Updated: Flip-chip 4 mechanical data <a href="#">Table 6 on page 13</a> and <a href="#">Figure 22 on page 14</a> .

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