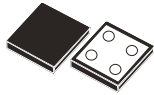


## Low input voltage, 200 mA ultra-low noise LDO



Flip-Chip4



SOT23-5L

**Maturity status link**[LD56020](#)

### Features

- Input voltage from 1.1 V to 5.5 V
- Ultra-low dropout voltage (190 mV max. at 200 mA load)
- Low ground current (18  $\mu$ A typ. at no load)
- Output voltage tolerance:  $\pm 2\%$  overtemperature,  $\pm 1\%$  at 25 °C
- 200 mA guaranteed output current
- Ultra-low output noise: 8.8  $\mu$ V<sub>RMS</sub> (10 Hz to 100 kHz)
- 50 mV output voltage steps (available on request) from 0.6 V to 4.0 V
- Logic-controlled electronic shutdown
- Thermal shutdown
- Output active discharge function
- Packages: Flip-chip4 0.65 x 0.65 mm<sup>2</sup> and SOT23-5L

### Applications

- Smartphones/tablets
- Image sensors
- VCO and RF modules

### Description

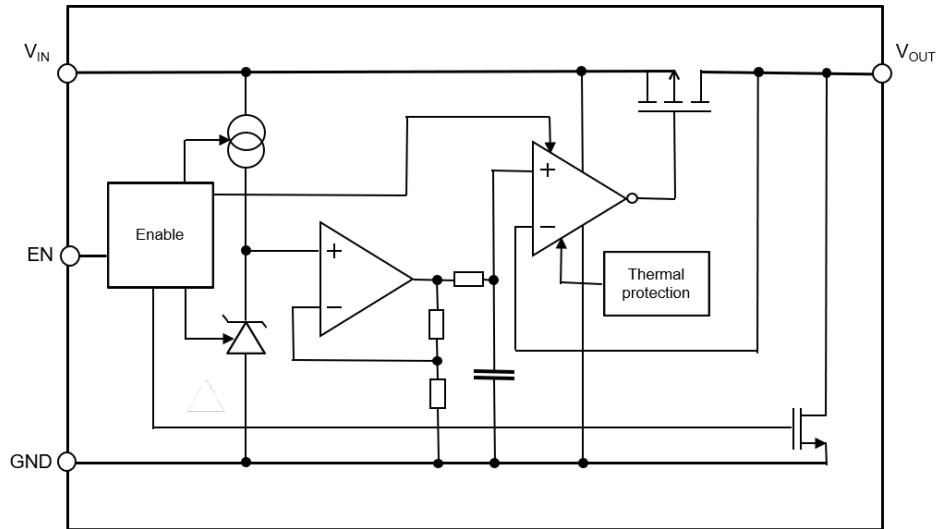
The **LD56020** is a high accuracy voltage regulator which provides 0.2 A of current. It is available in CSP 0.65 x 0.65 mm<sup>2</sup> package, SOT23-5L, allowing the maximum space saving.

The device is stabilized with a small ceramic capacitor on input and output. The ultra-low drop, low quiescent current and short-circuit current foldback make the **LD56020** suitable for low power battery-operated applications.

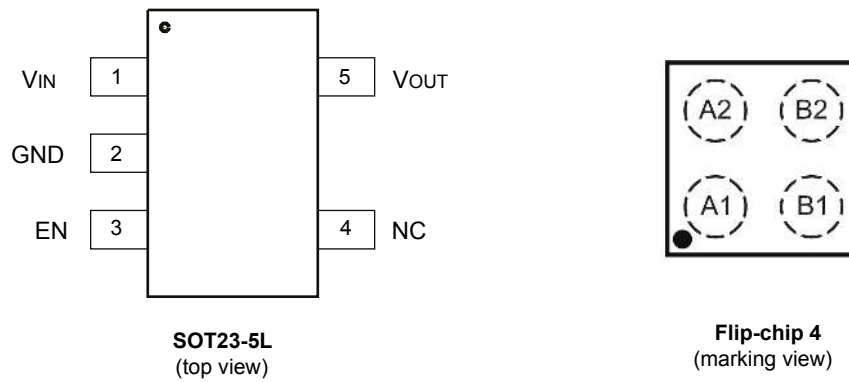
An enable logic control function puts the **LD56020** in shutdown mode allowing a total current consumption lower than 0.1  $\mu$ A. Thermal protection is also included.

# 1 Diagram

Figure 1. Block diagram



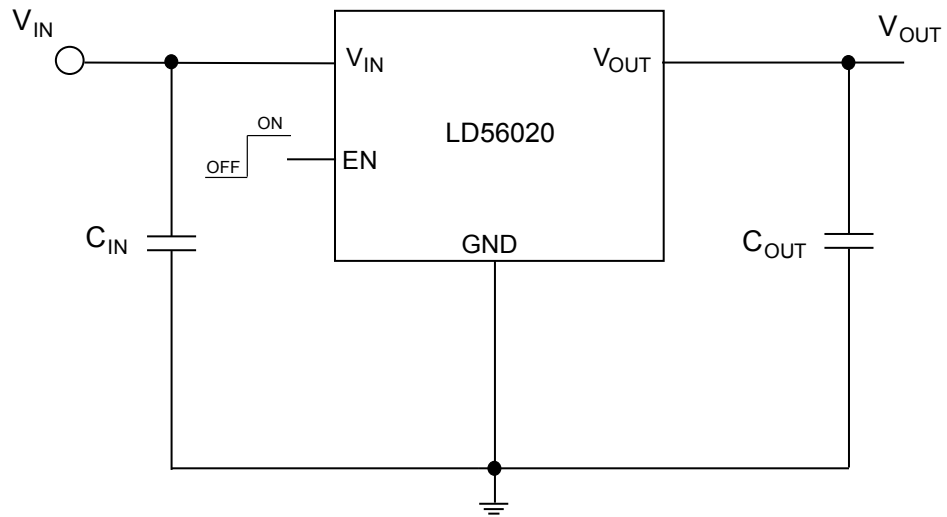
## 2 Pin configuration

**Figure 2. Pin connection**

**Table 1. Pin description**

Symbol	SOT23-5L	Flip-Chip 4	Description
V <sub>IN</sub>	1	A1	LDO Supply voltage
V <sub>OUT</sub>	5	A2	LDO Output voltage
GND	2	B2	Ground
EN	3	B1	Enable input: set V <sub>EN</sub> = high to turn on the device; V <sub>EN</sub> = low to turn off the device. This pin is internally pulled down via a 1 MΩ resistor
NC	4	-	Not internally connected: can be connected to GND
Exposed pad	-	-	Must be connected to GND.

### 3 Typical application diagram

Figure 3. Application diagram



## 4 Maximum ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{IN}$	Input supply voltage	- 0.3 to 7	V
$V_{OUT}$	Output voltage	- 0.3 to 7	V
$I_{OUT}$	Output current	Internally limited	A
EN	Enable pin voltage	- 0.3 to $V_{IN} + 0.3$	V
PD	Power dissipation	Internally limited	W
ESD	Charge device model	$\pm 1000$	V
	Human body model	$\pm 2000$	
$T_{J-OP}$	Operating junction temperature	- 40 to 125	°C
$T_{J-MAX}$	Maximum junction temperature	150	°C
$T_{STG}$	Storage temperature	- 55 to 150	°C

**Table 3. Thermal data**

Symbol	Parameter	Flip-Chip4	SOT23-5L	Unit
$R_{thja}$	Thermal resistance, junction-to-ambient	210	200	°C/W

## 5 Electrical characteristics

$V_{IN} = V_{OUT(NOM)} + 0.3 \text{ V}$ ;  $I_{OUT} = 1 \text{ mA}$ ;  $C_{IN} = 1 \mu\text{F}$ ;  $C_{OUT} = 1 \mu\text{F}$ ;  $V_{EN} = 1 \text{ V}$ ; typical values are at  $T_J = 25 \text{ }^\circ\text{C}$ ; min/max values are at  $-40 \text{ }^\circ\text{C} \leq T_J \leq 85 \text{ }^\circ\text{C}$ , unless otherwise specified.

**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{IN}$	Operating input voltage		1.1		5.5	V
$V_{OUT}$	Output voltage accuracy	$V_{OUT(NOM)} + 0.3 \text{ V} \leq V_{IN} \leq 5.5 \text{ V}$ ; $V_{OUT} \geq 1.5 \text{ V}$	-2.0		+2.0	%
		$V_{OUT(NOM)} + 0.3 \text{ V} \leq V_{IN} \leq 5.5 \text{ V}$ ; $V_{OUT} \leq 1.5 \text{ V}$	-30		+30	mV
$V_{OUT}$	Output voltage range	50 mV steps	0.6		4.0	V
$\Delta V_{OUT-IN}$	$V_{IN}$ Static regulation	$V_{OUT(NOM)} + 0.3 \text{ V} \leq V_{IN} \leq 5.0 \text{ V}$ , $I_{OUT} = 1 \text{ mA}$		0.01	0.1	%/V
$\Delta V_{OUT}$	Static load regulation for CSP	$I_{OUT} = 1 \text{ mA}$ to 200 mA		1.5	5	mV
	Static load regulation for SOT 23-5L	$I_{OUT} = 1 \text{ mA}$ to 200 mA		15	20	
$V_{DROP}$	Dropout voltage	$I_{OUT} = 0.05 \text{ A}$ ; $V_{OUT} = 1.05 \text{ V}$ $V_{OUT} = 97\%$ of $V_{OUT(NOM)}$		40	90	mV
$V_{DROP}$	Dropout voltage for CSP	$I_{OUT} = 0.10 \text{ A}$ ; $V_{OUT} = 1.05 \text{ V}$ $V_{OUT} = 97\%$ of $V_{OUT(NOM)}$		70	130	mV
		$I_{OUT} = 0.11 \text{ A}$ ; $V_{OUT} = 1.2 \text{ V}$ $V_{OUT} = 97\%$ of $V_{OUT(NOM)}$		60	140	
		$I_{OUT} = 0.2 \text{ A}$ ; $V_{OUT} = 1.2 \text{ V}$ $V_{OUT} = 97\%$ of $V_{OUT(NOM)}$		110	190	
	Dropout voltage for SOT 23-5L	$I_{OUT} = 0.10 \text{ A}$ ; $V_{OUT} = 1.05 \text{ V}$ $V_{OUT} = 97\%$ of $V_{OUT(NOM)}$		80	100	mV
		$I_{OUT} = 0.11 \text{ A}$ ; $V_{OUT} = 1.2 \text{ V}$ $V_{OUT} = 97\%$ of $V_{OUT(NOM)}$		70	150	
		$I_{OUT} = 0.2 \text{ A}$ ; $V_{OUT} = 1.2 \text{ V}$ $V_{OUT} = 97\%$ of $V_{OUT(NOM)}$		120	200	
eN	Output noise voltage	$V_{OUT(NOM)} = 1.0 \text{ V}$ ; $V_{IN} = 1.5 \text{ V}$ 10 Hz to 100 kHz, $I_{OUT} = 1 \text{ mA}$		8.8		$\mu\text{V}_{RMS}$
$SVR_{IN}$	$V_{IN}$ Supply voltage rejection	$V_{IN} = V_{OUT(NOM)} + 0.3 \text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.2 V_{pp}$ , Freq = 100 Hz, $I_{OUT} = 20 \text{ mA}$		90		dB
		$V_{IN} = V_{OUT(NOM)} + 0.3 \text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.2 V_{pp}$ , Freq = 1 kHz, $I_{OUT} = 20 \text{ mA}$		95		
		$V_{IN} = V_{OUT(NOM)} + 0.3 \text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.2 V_{pp}$ , Freq = 10 kHz, $I_{OUT} = 20 \text{ mA}$		85		
		$V_{IN} = V_{OUT(NOM)} + 0.3 \text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.2 V_{pp}$ , Freq = 100 kHz, $I_{OUT} = 20 \text{ mA}$		55		
$I_Q$	Quiescent current	$I_{OUT} = 0 \text{ mA}$		20	25	$\mu\text{A}$
$I_{Q\_OFF}$	Standby Current	$V_{EN} = \text{GND}$		0.01	1	$\mu\text{A}$

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{LIM}$	Output current limit	$V_{OUT} = 0.9 \times V_{OUT(NOM)}$	250	300		mA
$I_{SC}$	Short-circuit current	$V_{OUT} = 0$ (foldback protection)		100	TBD	mA
$V_{EN}$	Enable input logic low				0.2	V
	Enable input logic high		0.7			
$I_{EN}$	Enable pin input current	$V_{EN} = 1.1$ V (internal pull-down)		0.2	0.5	$\mu$ A
$T_{ON}$	Turn-on time	$V_{OUT(NOM)} = 1.0$ V		150		$\mu$ s
$T_{SHDN}$	Thermal shutdown			160		$^{\circ}$ C
	Hysteresis			20		

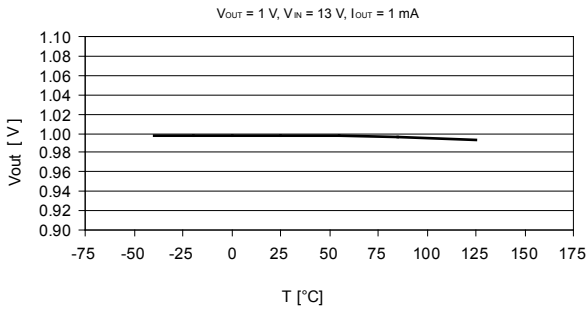
**Table 5. Recommended Input and output capacitors**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit
$C_{IN}$	Input capacitance	Stability	0.7	1		$\mu$ F
$C_{OUT}$	Output capacitance		0.7	1	10	
ESR	Output/Input capacitance		5		500	m $\Omega$

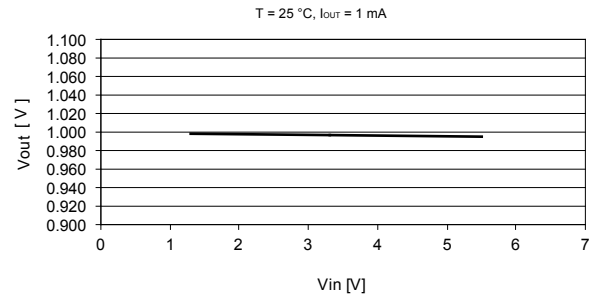
## 6 Typical performance characteristics

The following plots are referred to LD56020 in the typical application circuit and, unless otherwise noted, at  $T_A = 25\text{ }^\circ\text{C}$

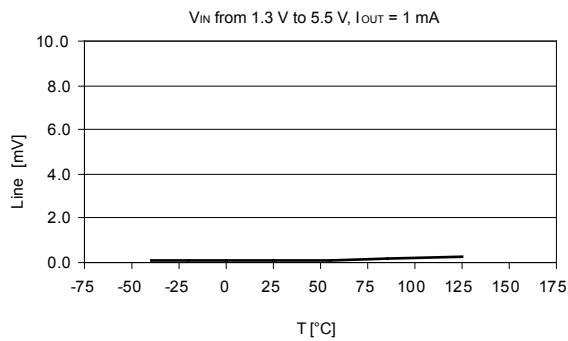
**Figure 4. Output voltage vs. temperature ( $V_{IN} = 1.4\text{ V}$ )**



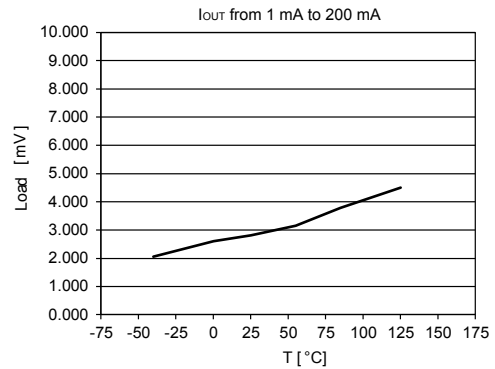
**Figure 5. Output voltage vs.  $V_{IN}$**



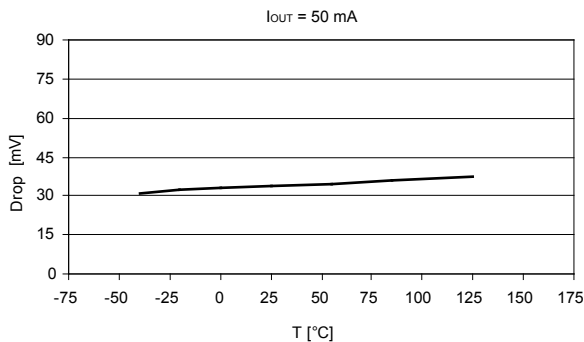
**Figure 6. Line regulation vs. temperature**



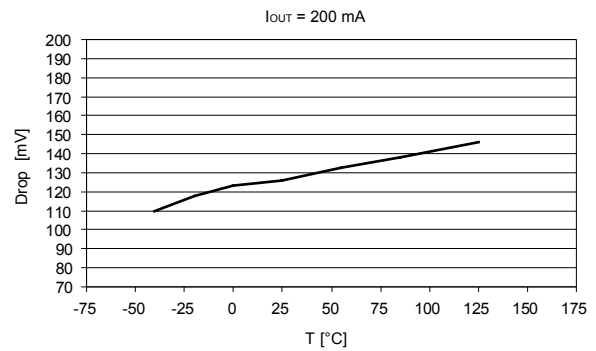
**Figure 7. Load regulation vs. temperature**



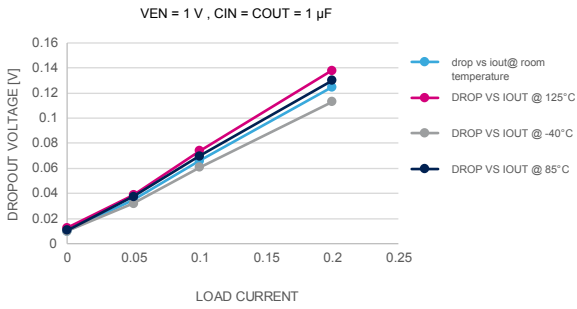
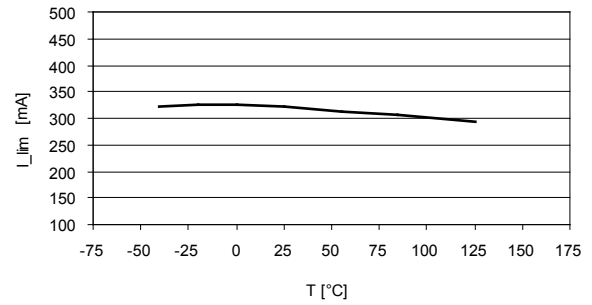
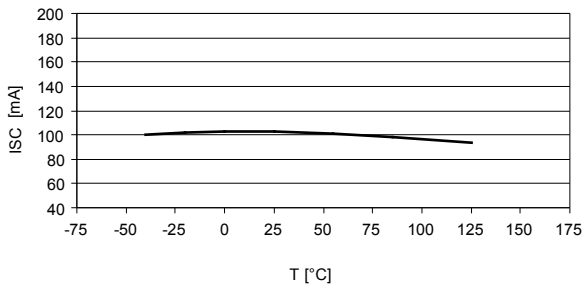
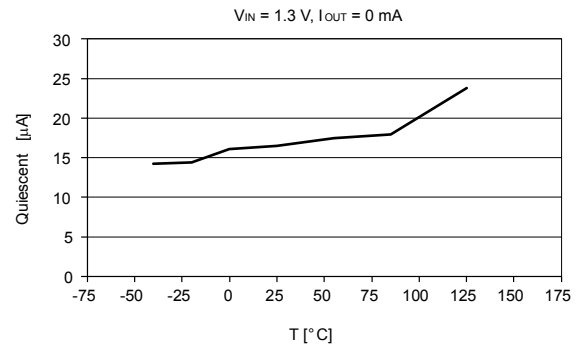
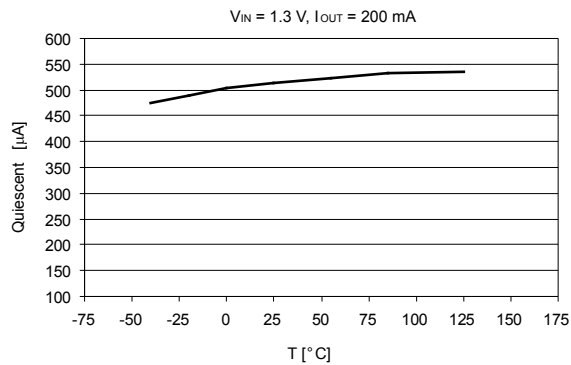
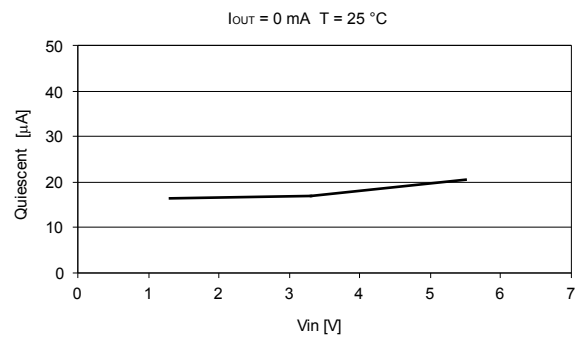
**Figure 8. Dropout voltage vs. temperature, ( $I_{OUT} = 50\text{ mA}$ )**



**Figure 9. Dropout voltage vs. temperature, ( $I_{OUT} = 200\text{ mA}$ )**





**Figure 10. Dropout voltage vs. output current**

**Figure 11. I<sub>LIM</sub> vs. temperature**

**Figure 12. I<sub>short</sub> vs. temperature**

**Figure 13. Quiescent current vs. temperature**

**Figure 14. Quiescent current vs. temperature I<sub>OUT</sub> = 200 mA**

**Figure 15. Quiescent current vs. input voltage**


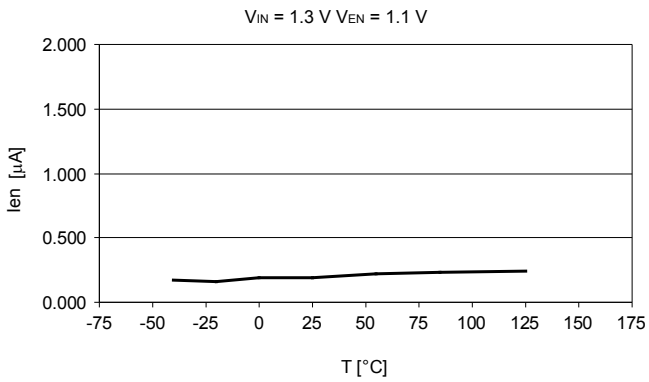
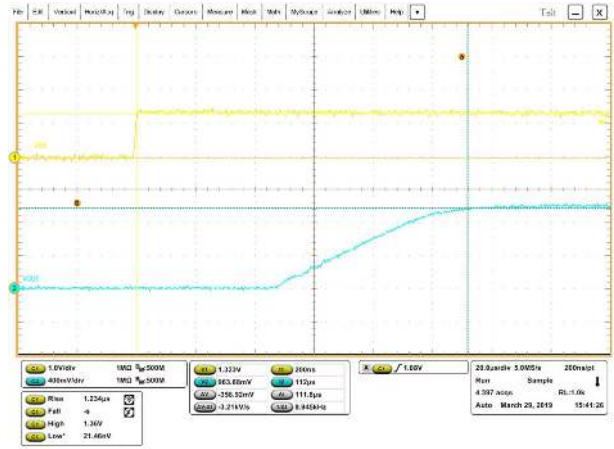
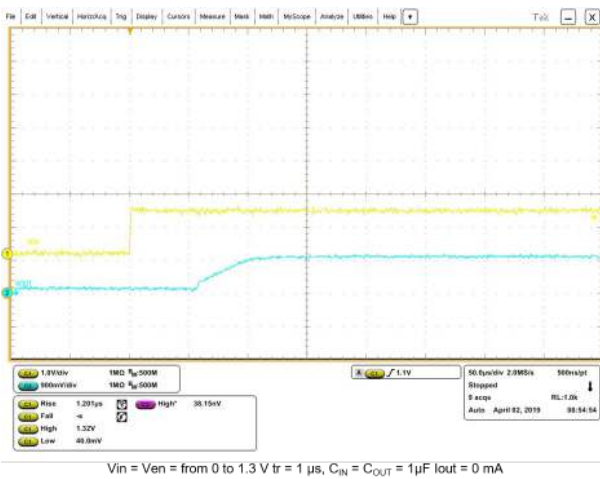
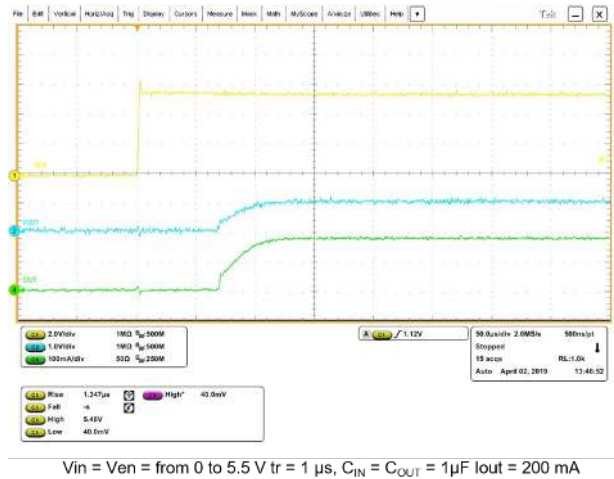
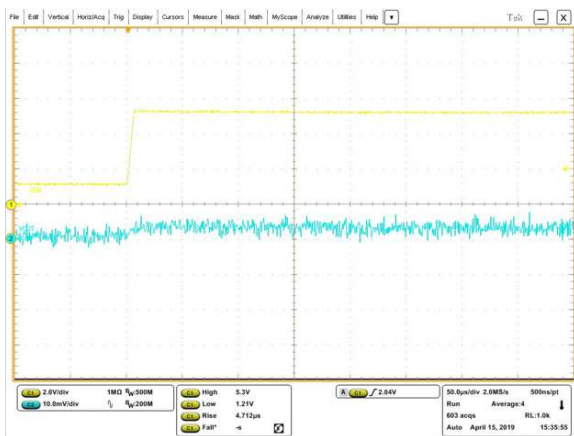
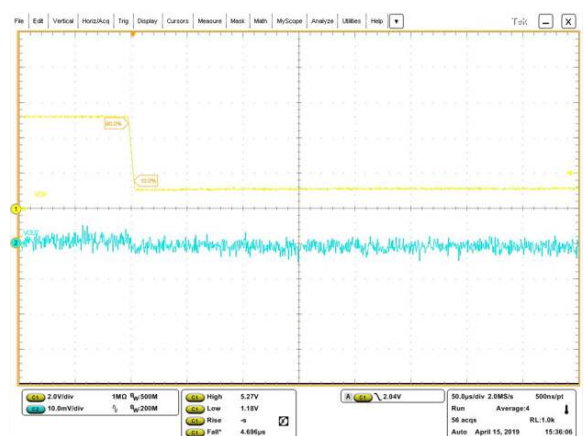
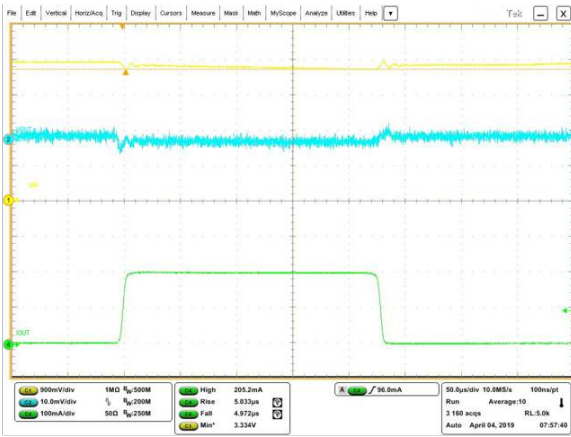
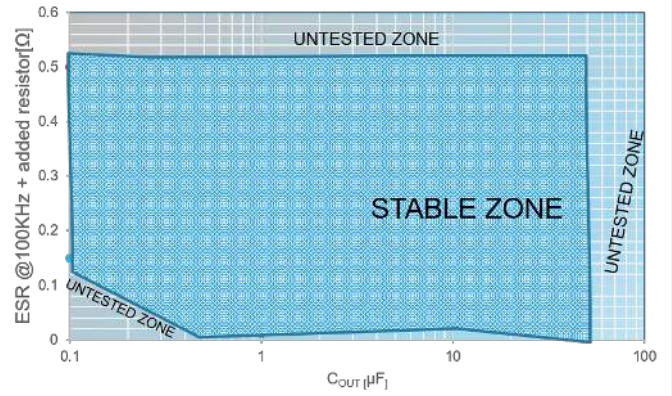
**Figure 16. Enable current vs. temperature**

**Figure 17. Turn-on time**

**Figure 18. Turn-on time  $I_{OUT} = 0\text{ mA}$** 

**Figure 19. Turn-on time  $I_{OUT} = 200\text{ mA}$** 

**Figure 20. Line regulation transient**

**Figure 21. Line regulation transient ( $I_{OUT} = 1\mu\text{A}$ )**


Figure 22. Load transient



$V_{EN}=1\text{ V}$ ,  $V_{in}=3.3\text{ V}$ ,  $I_{out}=1\text{ mA}$  to  $200\text{ mA}$ ,  $t_r=t_f=5\ \mu\text{s}$ ,  $C_{IN}=C_{OUT}=1\ \mu\text{F}$

Figure 23. Stability plane



$V_{EN}=1\text{ V}$ ,  $V_{in}=\text{from } V_{out}(\text{nom})+0.3\text{ V}$  to  $5.5\text{ V}$ ,  $I_{out}=\text{from } 1\text{ mA}$  to  $200\text{ mA}$ ,  $C_{IN}=1\ \mu\text{F}$

## 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 package information

Figure 24. SOT23-5L package outline

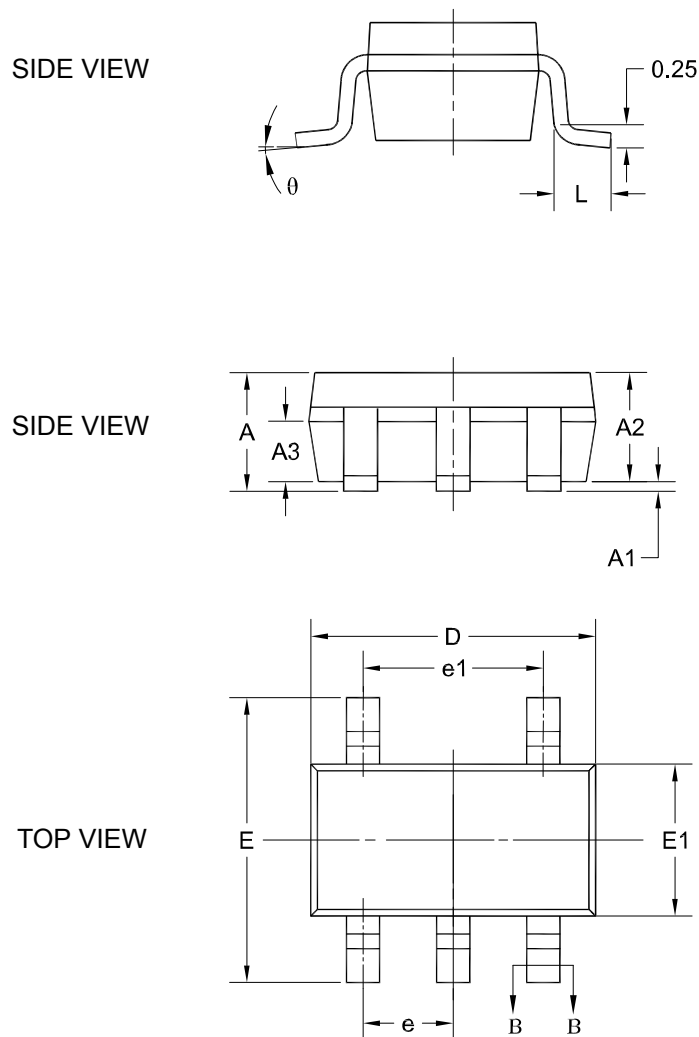
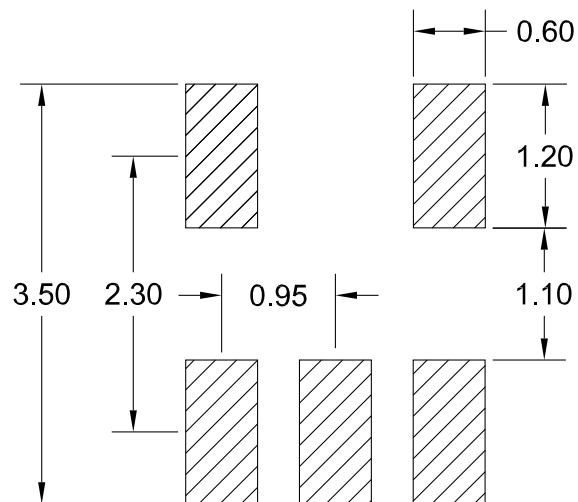


Table 6. SOT23-5L mechanical data

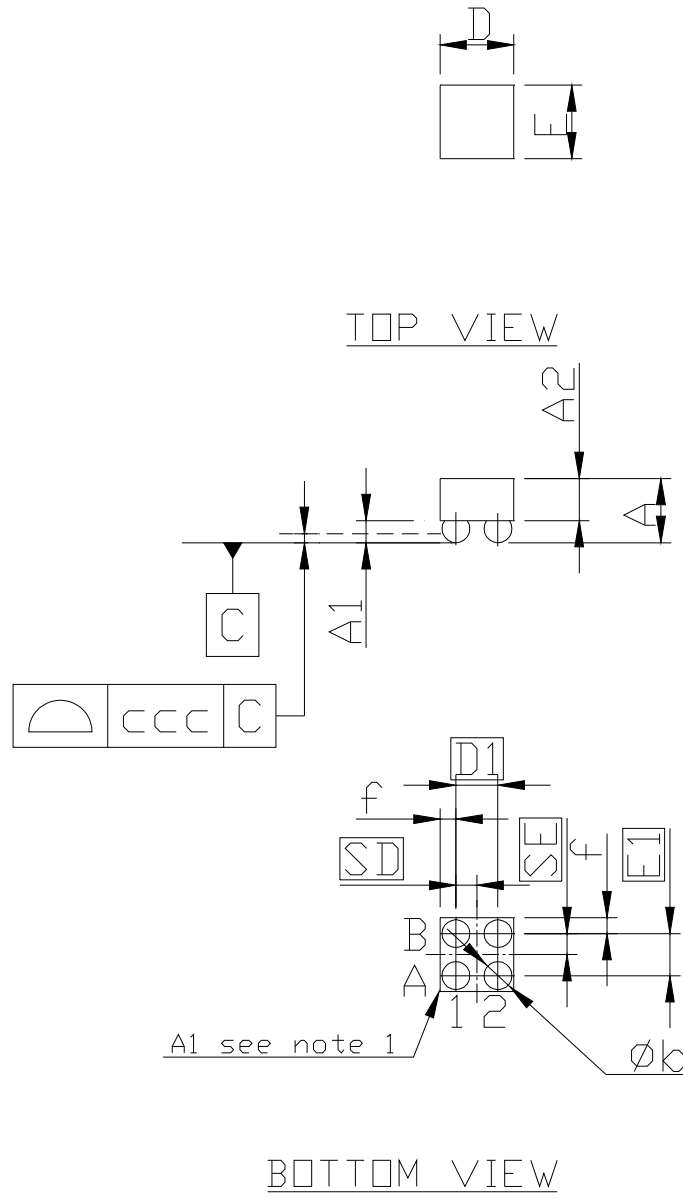
Dim.	mm		
	Min.	Typ.	Max.
A			1.25
A1	0.04		0.10
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.33		0.41
b1	0.32	0.35	0.38
c	0.15		0.19
c1	0.14	0.15	0.16
D	2.82	2.92	3.02
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95 CS		
e1	1.90 BSC		
L	0.30		0.60
Θ	0		8°

Figure 25. SOT23-5L recommended footprint



## 7.2 Flip-chip 4 package information

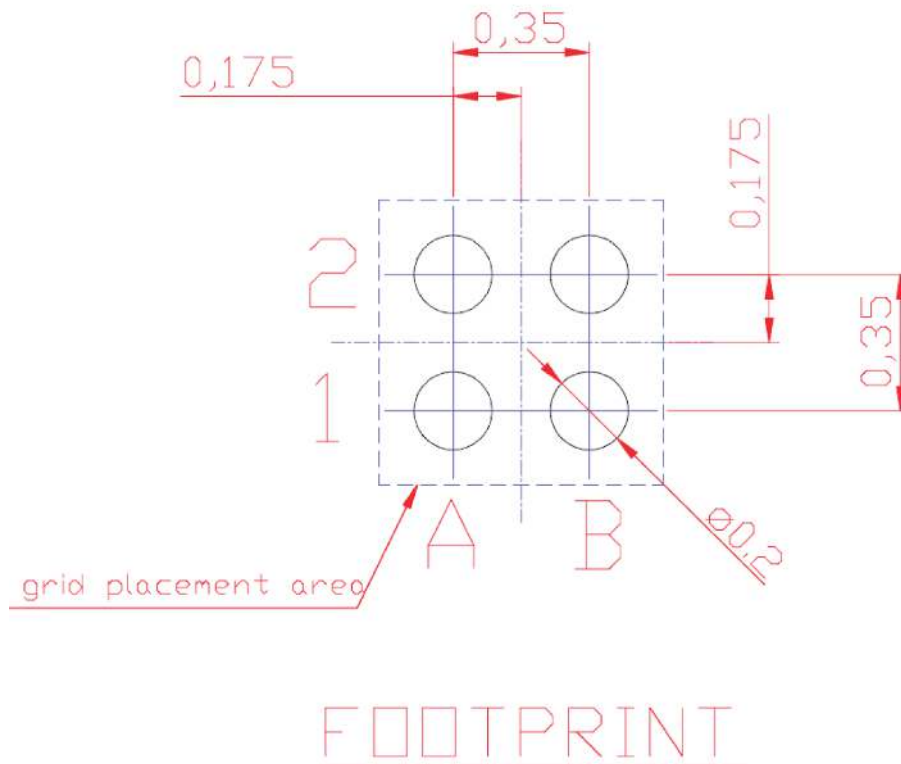
Figure 26. Flip-chip 4 package mechanical outline



8387748 option F

**Table 7. Flip-chip 4 mechanical data**

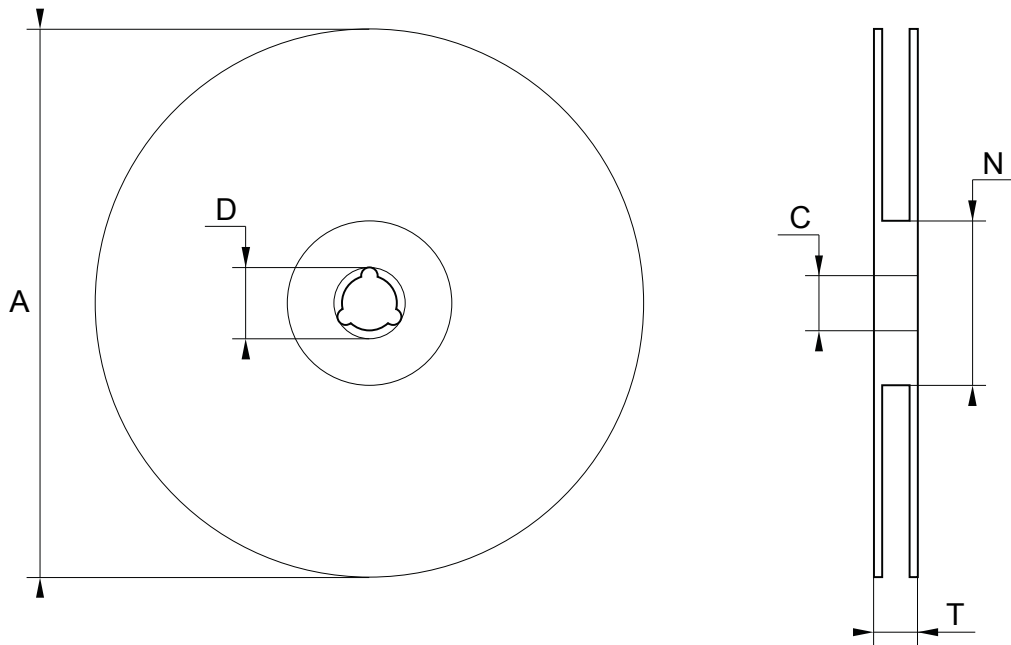
Dim.	mm		
	Min.	Typ.	Max.
A	0.375	0.410	0.445
A1	0.145	0.160	0.175
A2	0.230	0.250	0.270
b	0.189	0.210	0.231
D	0.660	0.690	0.72
D1		0.350	
E	0.660	0.690	0.720
E1		0.350	
SD		0.175	
SE		0.175	
f		0.170	
ccc		0.075	

**Figure 27. Flip-chip 4 package footprint**


### 7.3 Flip-chip 4 packing information

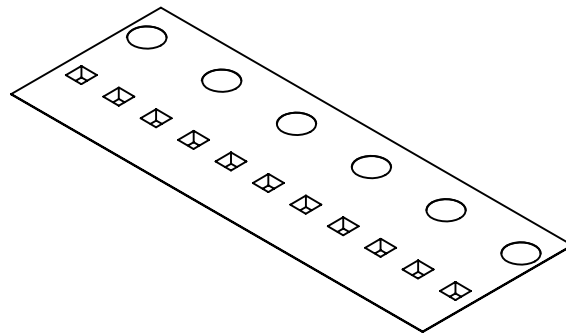
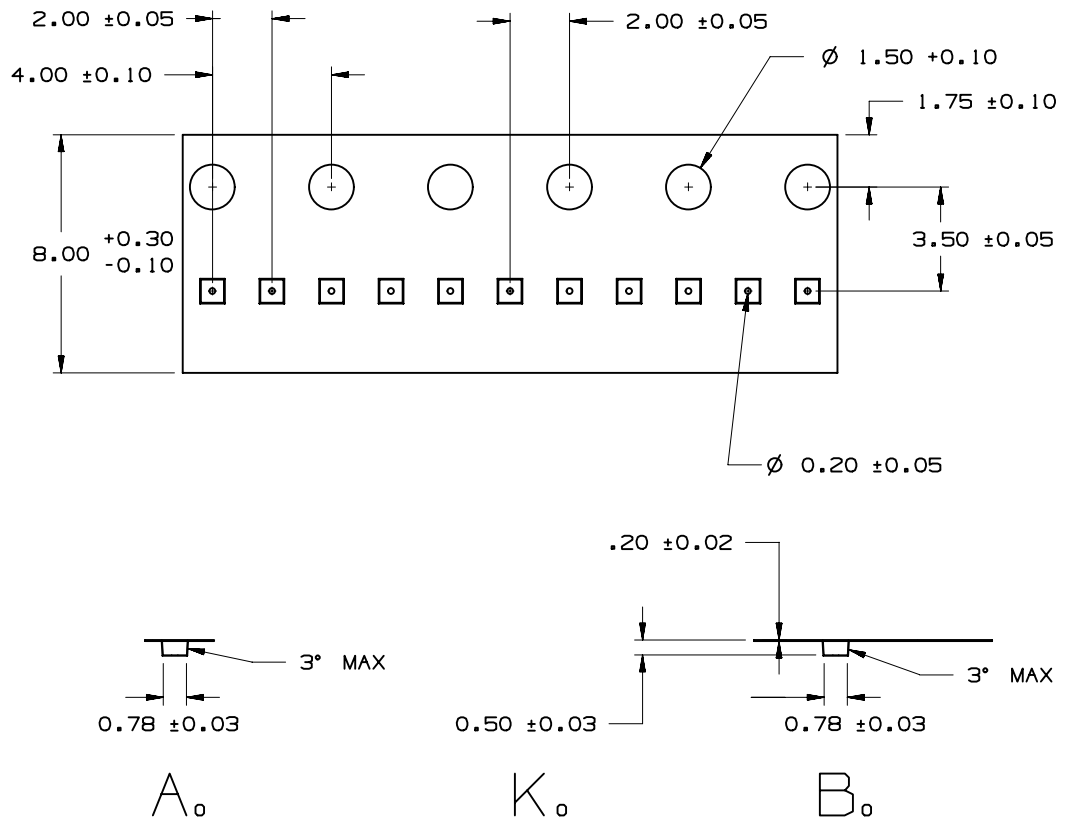
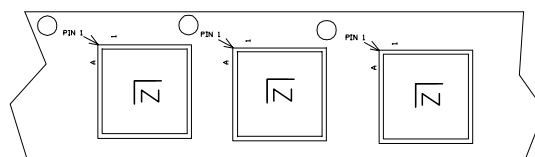
**Table 8. Reel mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A			180
C	12.8	13	13.2
D	20.2		
N	60		
T			14.4

**Figure 28. Reel**


Note: Drawing not in scale



**Figure 29. Tape drawing**

**Figure 30. Reel orientation**
**MARKING VIEW**


## 8 Ordering information

**Table 9. Order codes**

Order code	Package	Output voltage	Marking	Packing
LD56020M100R	SOT23-5L <sup>(1)</sup>	1.0 V	TBD	Tape and reel
LD56020M110R		1.1 V	TBD	
LD56020M120R		1.2 V		
LD56020M180R		1.8 V		
LD56020M300R		3.0 V		
LD56020M330R		3.3 V		
LD56020J100R	Flip-Chip4	1.0 V	TBD	Tape and reel
LD56020J110R		1.1 V	TBD	
LD56020J120R		1.2 V		
LD56020J180R		1.8 V		
LD56020J300R <sup>(1)</sup>		3.0 V		
LD56020J330R <sup>(1)</sup>		3.3 V		

1. Available on request.

---

## Revision history

**Table 10. Document revision history**

Date	Revision	Changes
01-Mar-2022	1	Initial release.

---

## Contents

<b>1</b>	<b>Diagram</b> .....	<b>2</b>
<b>2</b>	<b>Pin configuration</b> .....	<b>3</b>
<b>3</b>	<b>Typical application diagram</b> .....	<b>4</b>
<b>4</b>	<b>Maximum ratings</b> .....	<b>5</b>
<b>5</b>	<b>Electrical characteristics</b> .....	<b>6</b>
<b>6</b>	<b>Typical performance characteristics</b> .....	<b>8</b>
<b>7</b>	<b>Package information</b> .....	<b>12</b>
7.1	SOT23-5L package information .....	12
7.2	Flip-chip 4 package information .....	14
7.3	Flip-chip 4 packing information .....	16
<b>8</b>	<b>Ordering information</b> .....	<b>18</b>
	<b>Revision history</b> .....	<b>19</b>

## List of tables

<b>Table 1.</b>	Pin description . . . . .	3
<b>Table 2.</b>	Absolute maximum ratings . . . . .	5
<b>Table 3.</b>	Thermal data . . . . .	5
<b>Table 4.</b>	Electrical characteristics . . . . .	6
<b>Table 5.</b>	Recommended Input and output capacitors . . . . .	7
<b>Table 6.</b>	SOT23-5L mechanical data . . . . .	13
<b>Table 7.</b>	Flip-chip 4 mechanical data . . . . .	15
<b>Table 8.</b>	Reel mechanical data . . . . .	16
<b>Table 9.</b>	Order codes . . . . .	18
<b>Table 10.</b>	Document revision history . . . . .	19

## List of figures

<b>Figure 1.</b>	Block diagram . . . . .	2
<b>Figure 2.</b>	Pin connection . . . . .	3
<b>Figure 3.</b>	Application diagram. . . . .	4
<b>Figure 4.</b>	Output voltage vs. temperature ( $V_{IN} = 1.4\text{ V}$ ) . . . . .	8
<b>Figure 5.</b>	Output voltage vs. $V_{IN}$ . . . . .	8
<b>Figure 6.</b>	Line regulation vs. temperature . . . . .	8
<b>Figure 7.</b>	Load regulation vs. temperature . . . . .	8
<b>Figure 8.</b>	Dropout voltage vs. temperature, ( $I_{OUT} = 50\text{ mA}$ ) . . . . .	8
<b>Figure 9.</b>	Dropout voltage vs. temperature, ( $I_{OUT} = 200\text{ mA}$ ) . . . . .	8
<b>Figure 10.</b>	Dropout voltage vs. output current. . . . .	9
<b>Figure 11.</b>	$I_{LIM}$ vs. temperature . . . . .	9
<b>Figure 12.</b>	$I_{short}$ vs. temperature . . . . .	9
<b>Figure 13.</b>	Quiescent current vs. temperature. . . . .	9
<b>Figure 14.</b>	Quiescent current vs. temperature $I_{OUT} = 200\text{ mA}$ . . . . .	9
<b>Figure 15.</b>	Quiescent current vs. input voltage . . . . .	9
<b>Figure 16.</b>	Enable current vs. temperature . . . . .	10
<b>Figure 17.</b>	Turn-on time. . . . .	10
<b>Figure 18.</b>	Turn-on time $I_{OUT} = 0\text{ mA}$ . . . . .	10
<b>Figure 19.</b>	Turn-on time $I_{OUT} = 200\text{ mA}$ . . . . .	10
<b>Figure 20.</b>	Line regulation transient. . . . .	10
<b>Figure 21.</b>	Line regulation transient ( $I_{OUT} = 1\text{ }\mu\text{A}$ ) . . . . .	10
<b>Figure 22.</b>	Load transient . . . . .	11
<b>Figure 23.</b>	Stability plane. . . . .	11
<b>Figure 24.</b>	SOT23-5L package outline. . . . .	12
<b>Figure 25.</b>	SOT23-5L recommended footprint . . . . .	13
<b>Figure 26.</b>	Flip-chip 4 package mechanical outline . . . . .	14
<b>Figure 27.</b>	Flip-chip 4 package footprint. . . . .	15
<b>Figure 28.</b>	Reel . . . . .	16
<b>Figure 29.</b>	Tape drawing . . . . .	17
<b>Figure 30.</b>	Reel orientation . . . . .	17

**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. For additional information about ST trademarks, please refer to [www.st.com/trademarks](http://www.st.com/trademarks). 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.

© 2022 STMicroelectronics – All rights reserved