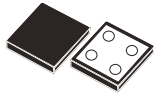
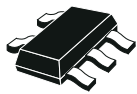


## Low input voltage, 200 mA ultra-low noise LDO



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

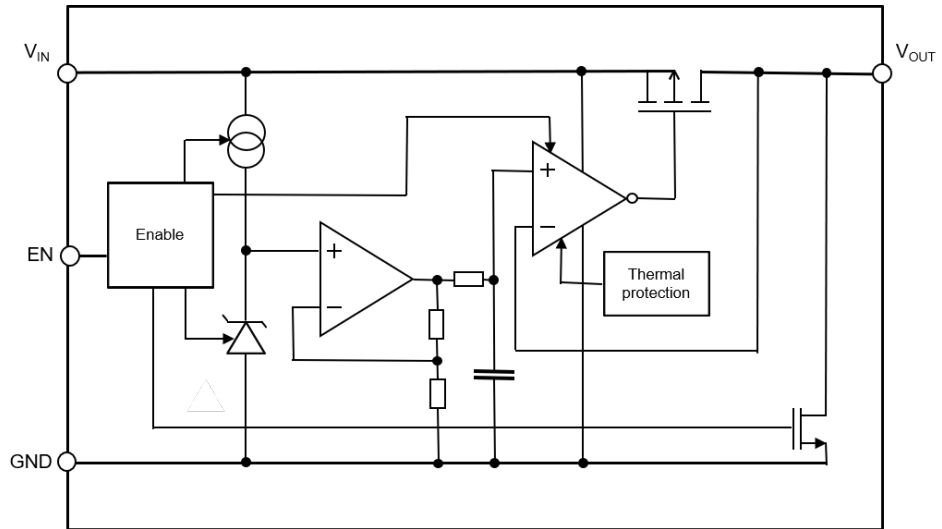
The **LD56020** is a high accuracy voltage regulator which provides 0.2 A of current. It is available in CSP 0.65 x 0.65 mm<sup>2</sup> package, SOT23-5L, allowing the maximum space saving.

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.

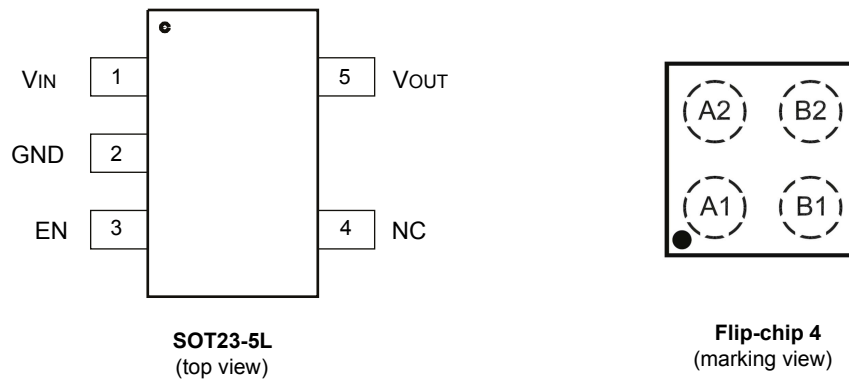
# 1 Diagram

Figure 1. Block diagram



## 2 Pin configuration

**Figure 2. Pin connection**

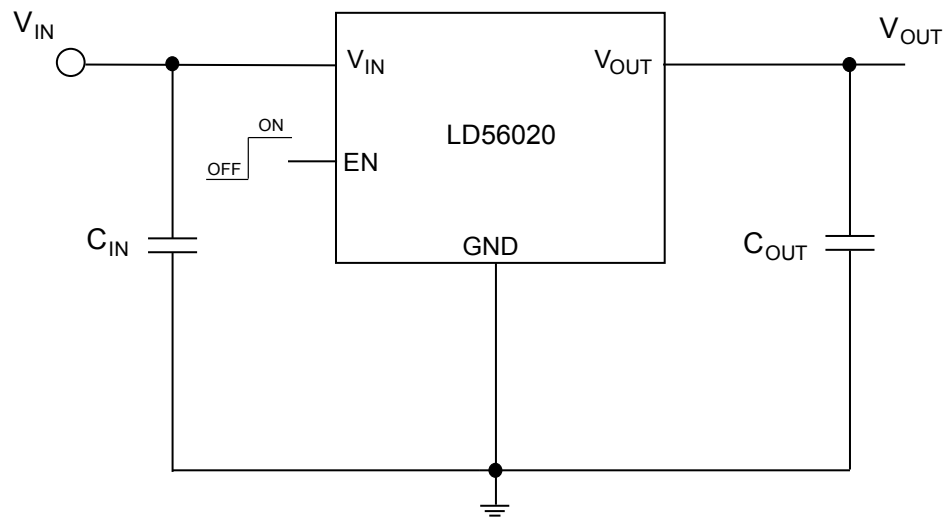


**Table 1. Pin description**

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

$V_{IN} = V_{OUT(NOM)} + 0.3\text{ V}$ ;  $I_{OUT} = 1\text{ mA}$ ;  $C_{IN} = 1\text{ }\mu\text{F}$ ;  $C_{OUT} = 1\text{ }\mu\text{F}$ ;  $V_{EN} = 1\text{ V}$ ; 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	$V_{IN} = V_{OUT(NOM)} + 0.3\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.2\text{ V}_{pp}$ , Freq = 100 Hz, $I_{OUT} = 20\text{ mA}$		90		dB
		$V_{IN} = V_{OUT(NOM)} + 0.3\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.2\text{ V}_{pp}$ , Freq = 1 kHz, $I_{OUT} = 20\text{ mA}$		95		
		$V_{IN} = V_{OUT(NOM)} + 0.3\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.2\text{ V}_{pp}$ , Freq = 10 kHz, $I_{OUT} = 20\text{ mA}$		85		
		$V_{IN} = V_{OUT(NOM)} + 0.3\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.2\text{ V}_{pp}$ , 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		

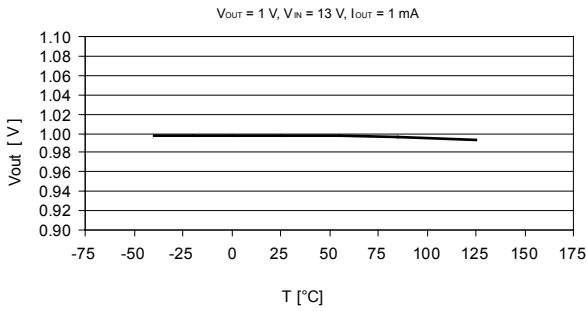
**Table 5. Recommended Input and output capacitors**

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 $\Omega$

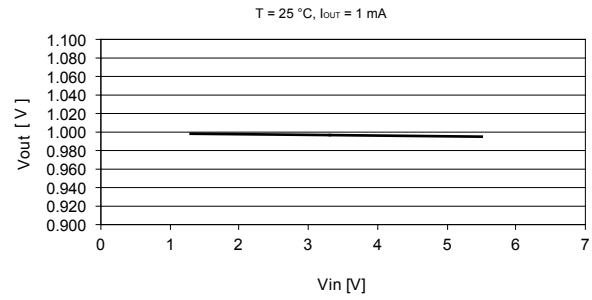
## 6 Typical performance characteristics

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

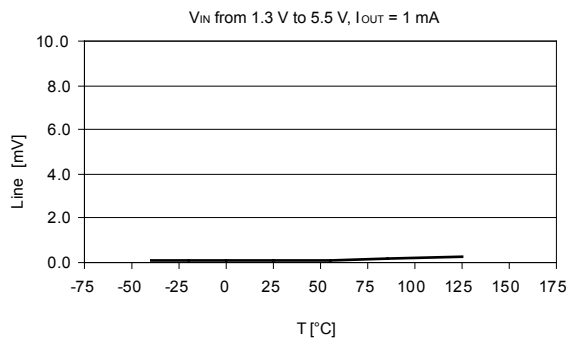
**Figure 4. Output voltage vs. temperature ( $V_{IN} = 1.4\text{ V}$ )**



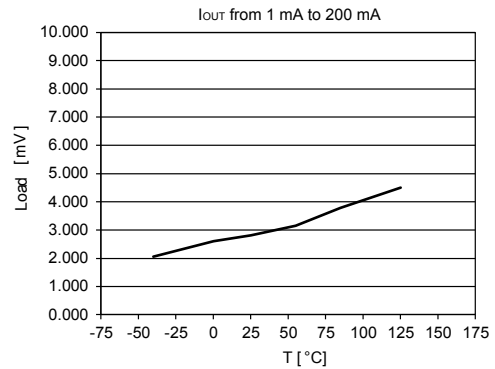
**Figure 5. Output voltage vs.  $V_{IN}$**



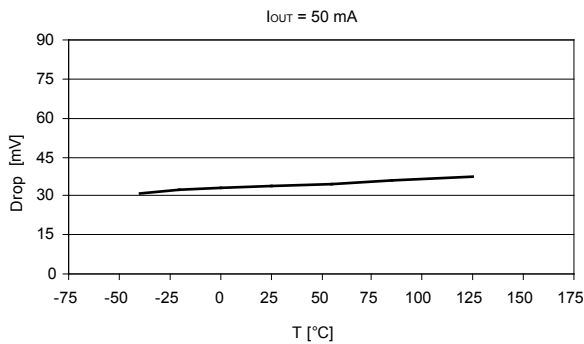
**Figure 6. Line regulation vs. temperature**



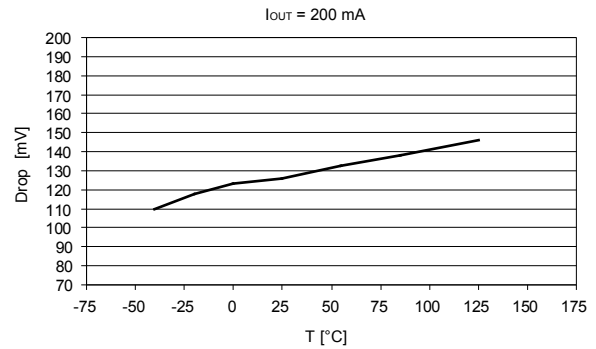
**Figure 7. Load regulation vs. temperature**



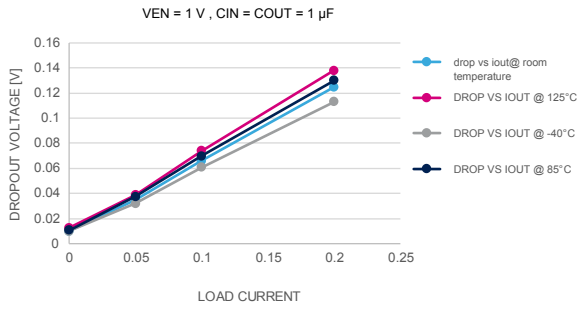
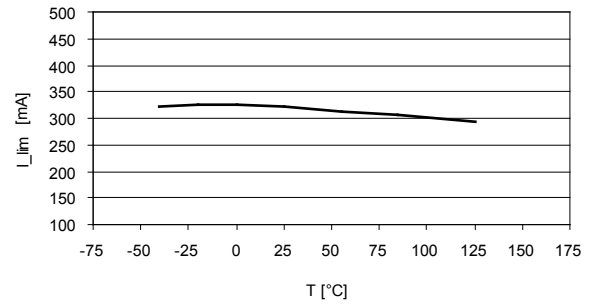
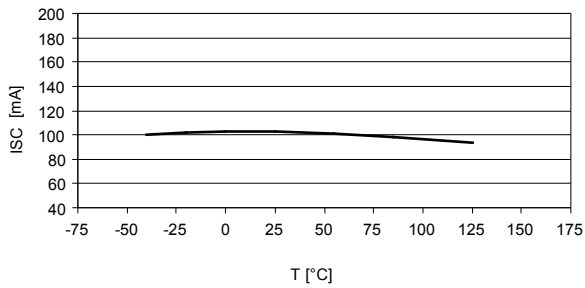
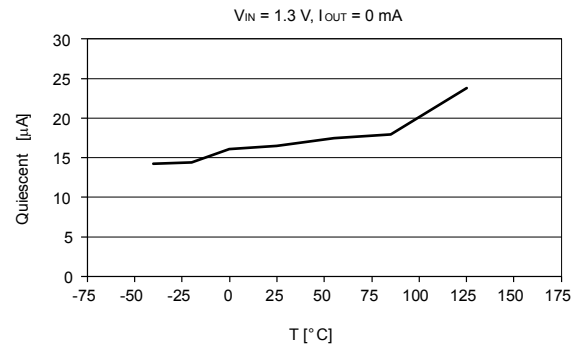
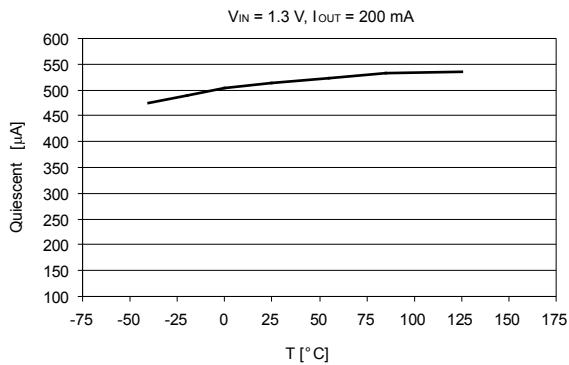
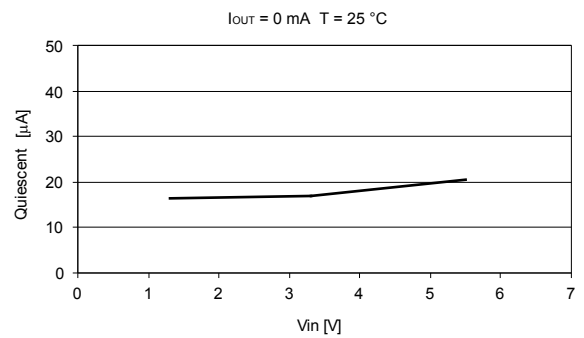
**Figure 8. Dropout voltage vs. temperature, ( $I_{OUT} = 50\text{ mA}$ )**



**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**


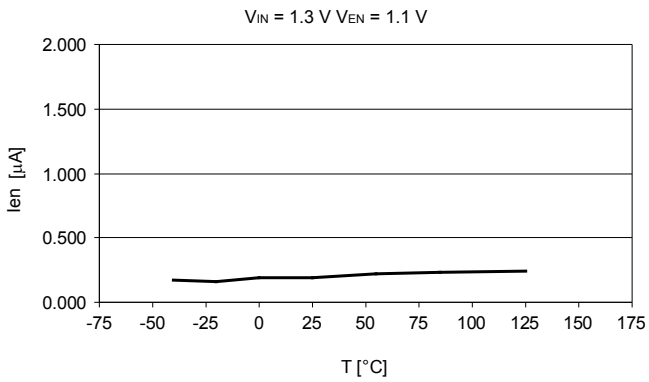
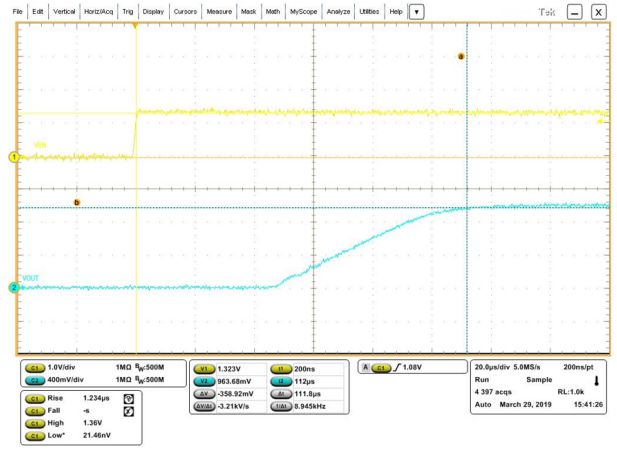
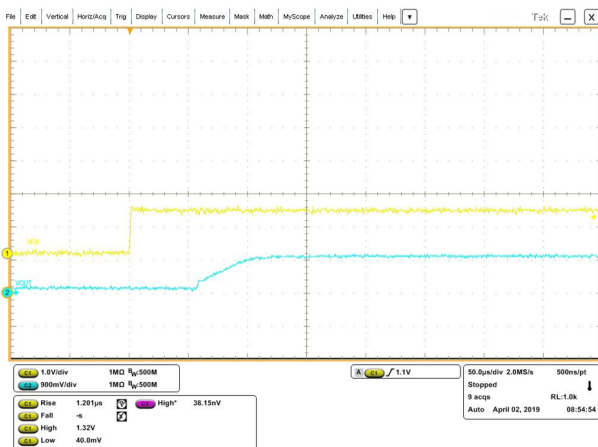
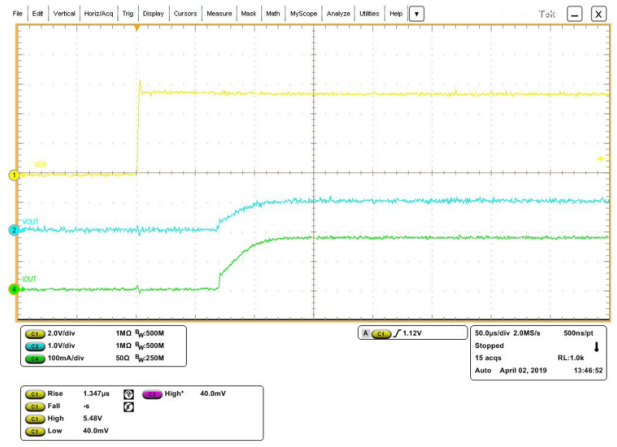
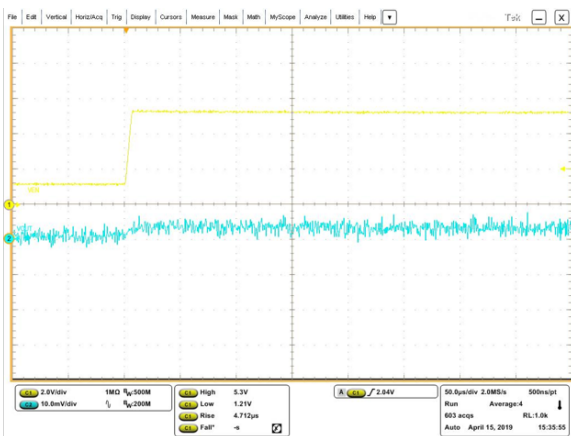
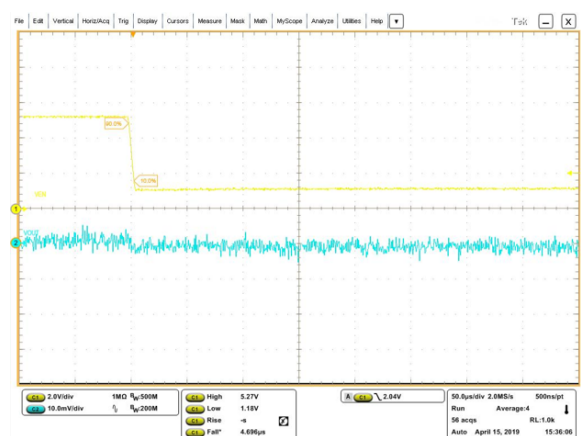
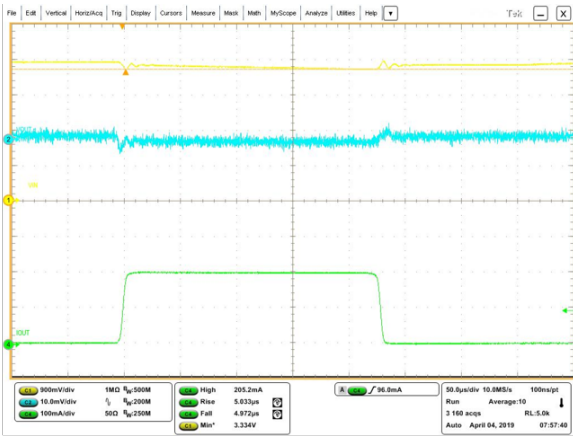
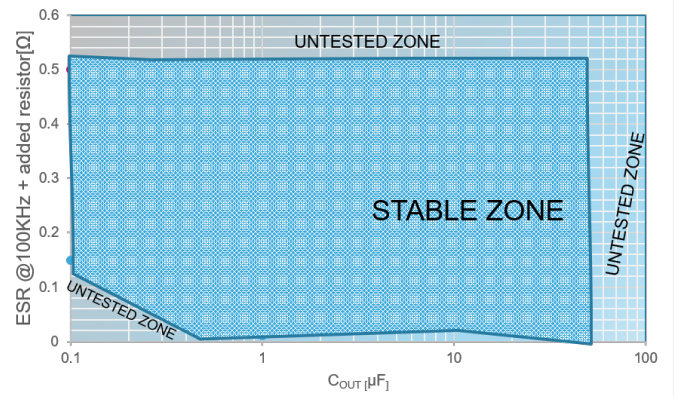
**Figure 16. Enable current vs. temperature**

**Figure 17. Turn-on time**

 $V_{in} = V_{out(nom)} + 0.3\text{ V}$ ,  $V_{en}$  from 0 to  $V_{in}$ ,  $t_r=t_f=1\mu\text{s}$ ,  $C_{IN} = C_{OUT} = 1\mu\text{F}$ ,  $I_{out} = 0\text{ mA}$ 
**Figure 18. Turn-on time  $I_{OUT} = 0\text{ mA}$** 

 $V_{in} = V_{en} =$  from 0 to 1.3 V  $t_r = 1\mu\text{s}$ ,  $C_{IN} = C_{OUT} = 1\mu\text{F}$   $I_{out} = 0\text{ mA}$ 
**Figure 19. Turn-on time  $I_{OUT} = 200\text{ mA}$** 

 $V_{in} = V_{en} =$  from 0 to 5.5 V  $t_r = 1\mu\text{s}$ ,  $C_{IN} = C_{OUT} = 1\mu\text{F}$   $I_{out} = 200\text{ mA}$ 
**Figure 20. Line regulation transient**

 $V_{EN}=1\text{V}$   $V_{in}=V_{out(nom)}+0.3\text{V}$  to 5.5V,  $t_r=t_f=5\mu\text{s}$   $I_{out}=1\text{mA}$   $C_{IN} = C_{OUT} = 1\mu\text{F}$ 
**Figure 21. Line regulation transient ( $I_{OUT} = 1\mu\text{A}$ )**

 $V_{EN}=1\text{V}$   $V_{in}=V_{out(nom)}+0.3\text{V}$  to 5.5V,  $t_r=t_f=5\mu\text{s}$   $I_{out}=1\text{mA}$   $C_{IN} = C_{OUT} = 1\mu\text{F}$

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



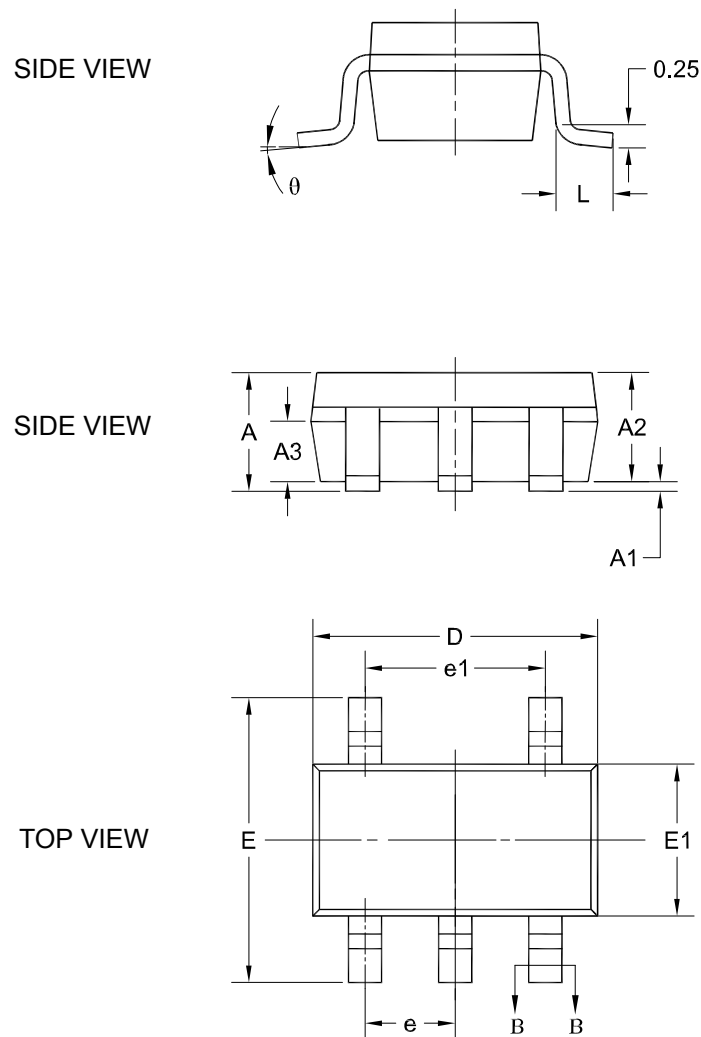
$V_{EN}=1\text{ V}$ ,  $V_{in}=\text{from }V_{out}(\text{nom})+0.3\text{ V to }5.5\text{ V}$ ,  $I_{out}=\text{from }1\text{ mA to }200\text{ mA}$ ,  $C_{IN}=1\ \mu\text{F}$

## 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.

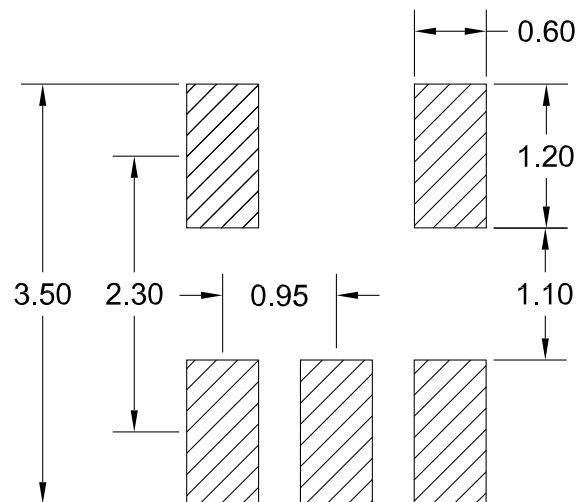
### 7.1 SOT23-5L package information

Figure 24. SOT23-5L package outline



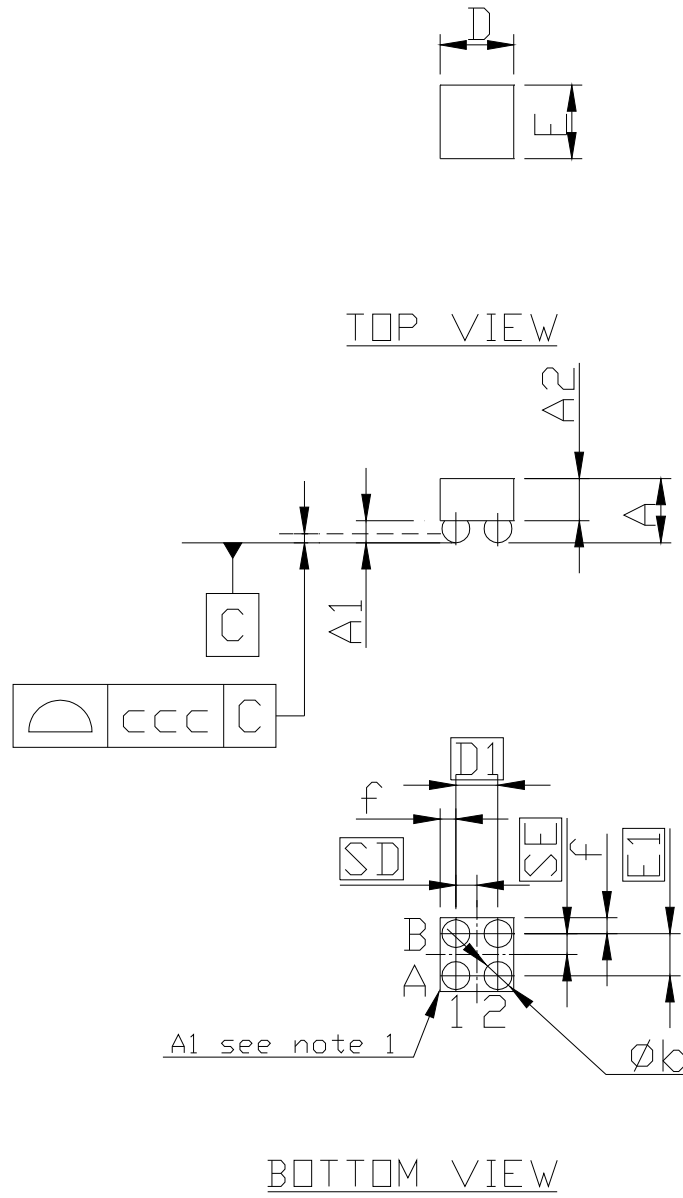
**Table 6. SOT23-5L mechanical data**

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

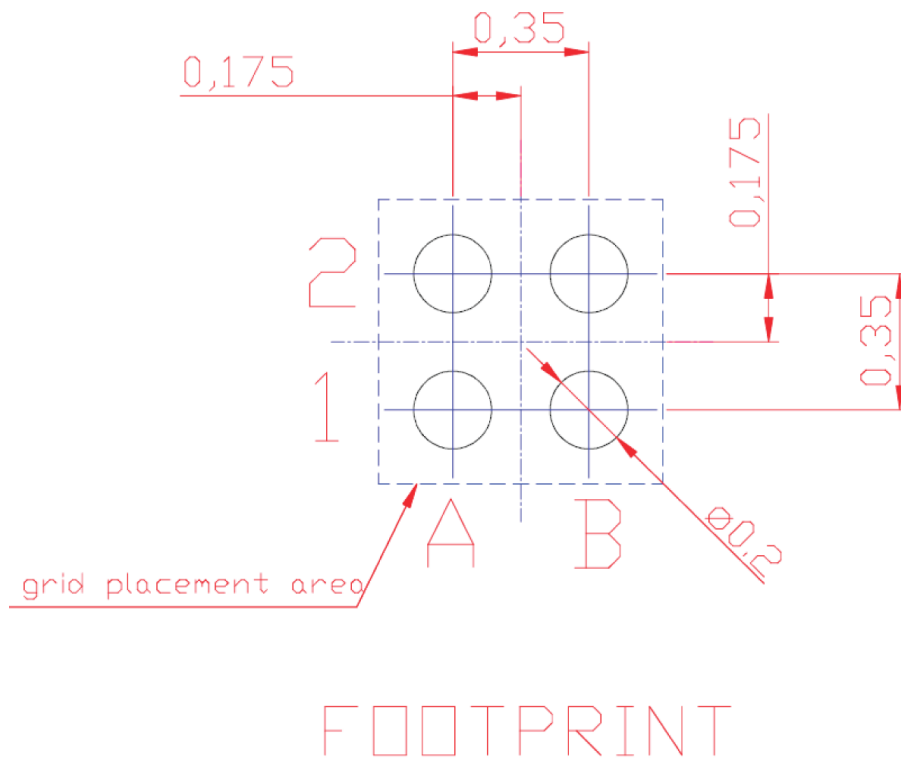
Figure 26. Flip-chip 4 package mechanical outline



8387748 option F

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

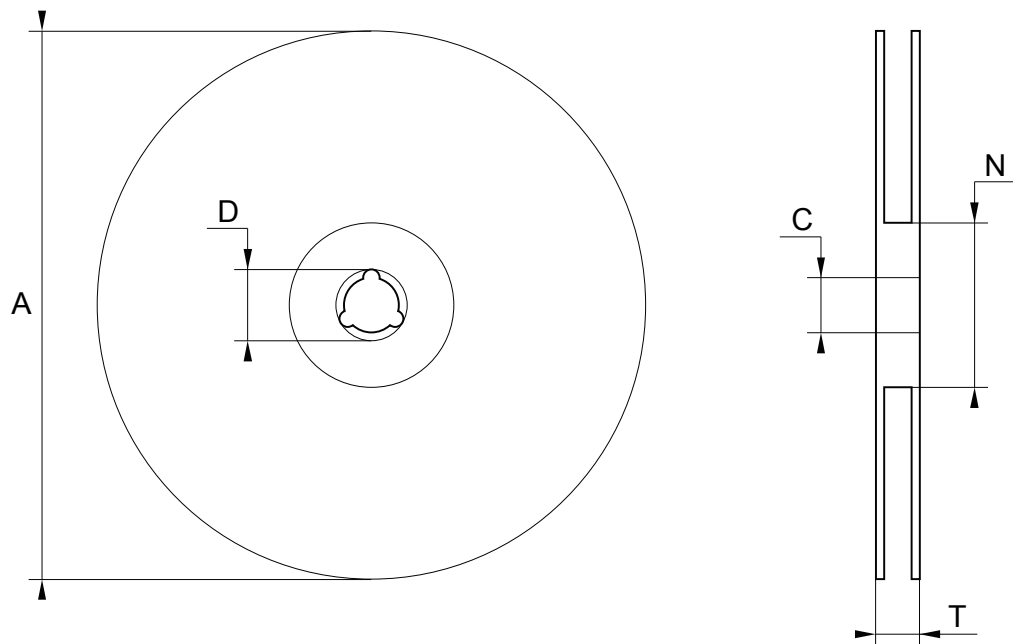
Dim.	mm		
	Min.	Typ.	Max.
A	0.375	0.410	0.445
A1	0.145	0.160	0.175
A2	0.230	0.250	0.270
b	0.189	0.210	0.231
D	0.660	0.690	0.72
D1		0.350	
E	0.660	0.690	0.720
E1		0.350	
SD		0.175	
SE		0.175	
f		0.170	
ccc		0.075	

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


### 7.3 Flip-chip 4 packing information

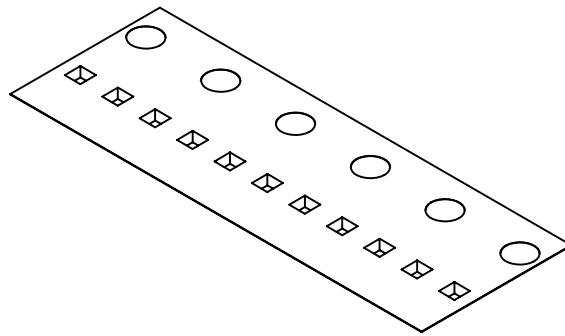
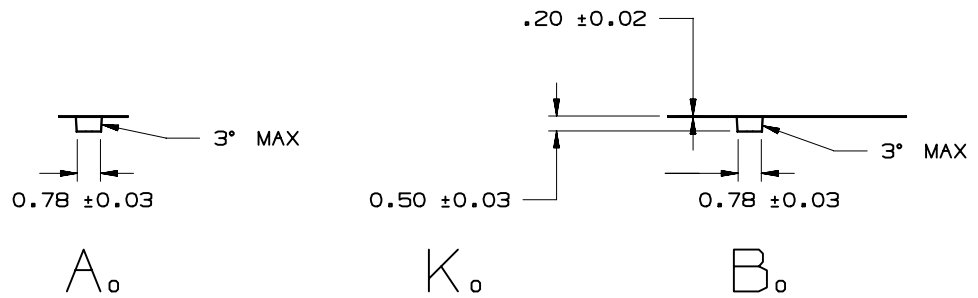
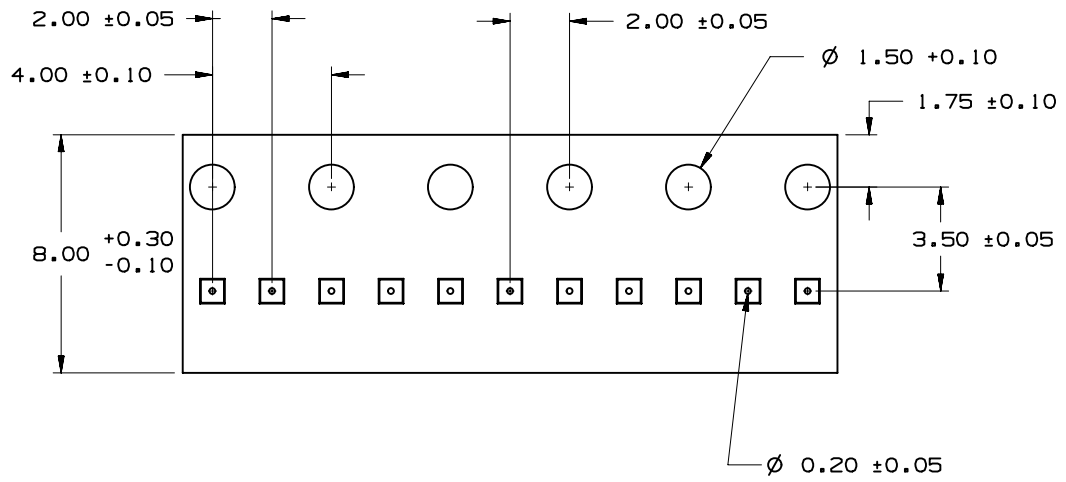
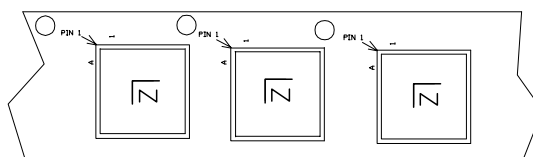
**Table 8. Reel mechanical data**

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.

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