

## 200 mA high accuracy and high PSRR voltage regulator



### Features

- Input voltage from 2.5 to 18 V
- Very low-dropout voltage (100 mV typ. @ 100 mA load)
- Low quiescent current (typ. 60  $\mu$ A, 1  $\mu$ A in off mode)
- High PSRR: 88 dB @ 120 Hz
- Low noise
- Output voltage tolerance:  $\pm 0.5\%$  @ 25  $^{\circ}$ C (LDK320A) or  $\pm 2\%$  25  $^{\circ}$ C
- Output current up to 200 mA
- Wide range of output voltages available on request: fixed from 1.2 V to 12 V with 100 mV step and adjustable
- Logic-controlled electronic shutdown
- Compatible with ceramic capacitor  $C_{OUT} = 1 \mu$ F
- Current, SOA and thermal protections
- Available in SOT23-5L and SOT-89 packages
- Temperature range: -40  $^{\circ}$ C to 125  $^{\circ}$ C

### Applications

- DSC
- TV
- BD, DVD
- PC
- Industrial

Maturity status link

LDK320

### Description

The LDK320 is a low drop voltage regulator, which provides a maximum output current of 200 mA from an input voltage in the range of 2.5 V to 18 V, with a typical dropout voltage of 100 mV.

It is stabilized with a ceramic capacitor on the output.

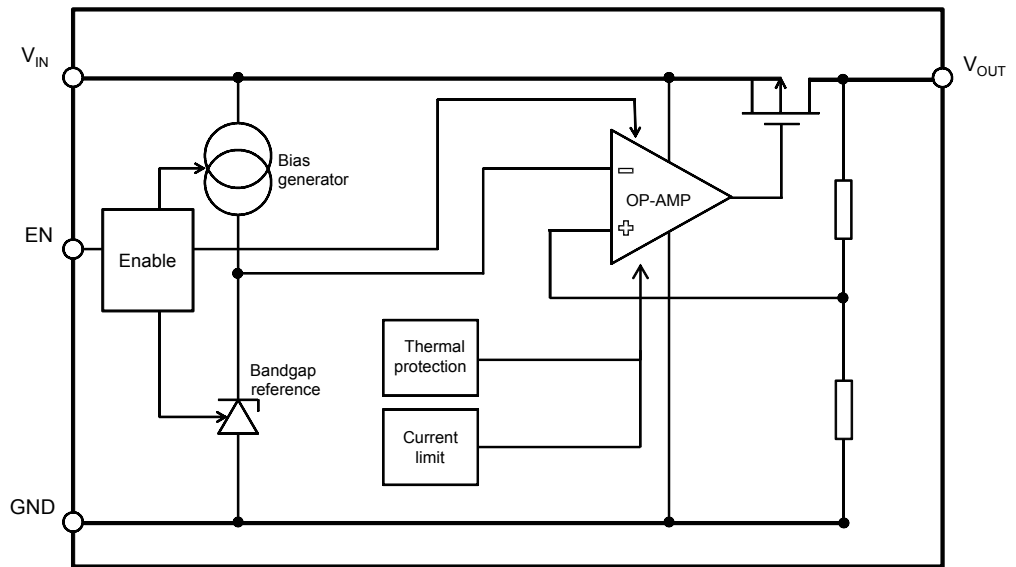
The very good dynamic characteristic, combined with low drop voltage and low quiescent current make it suitable for low power battery-powered applications.

The enable logic control function allows the LDK320 to be in shutdown mode by consuming a total current lower than 1  $\mu$ A.

This device also includes a short-circuit current limiting, thermal and SOA protections.

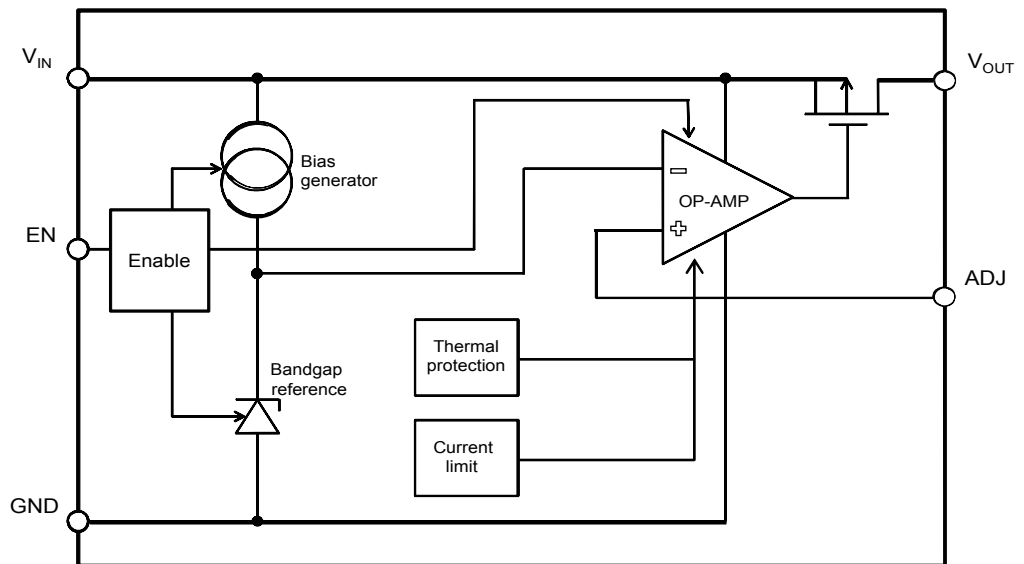
# 1 Diagram

Figure 1. Block diagram (fixed version)



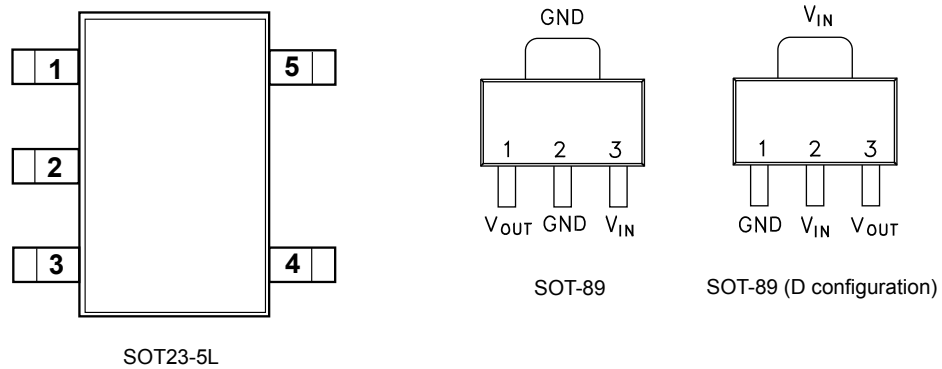
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Figure 2. Block diagram (adjustable version)



## 2 Pin configuration

**Figure 3. Pin connection (top view)**



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**Table 1. Pin description (SOT23-5L)**

Pin n°	Symbol	Function
1	IN	Input voltage of the LDO
2	GND	Common ground
3	EN	Enable pin logic input: low = shutdown, high = active
4	ADJ/NC	Adjustable pin on ADJ version, not connected on fixed version
5	OUT	Output voltage of the LDO

**Table 2. Pin description (SOT-89)**

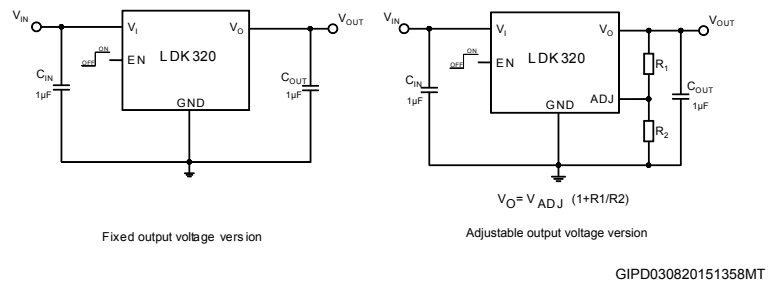
Pin n°	Symbol	Function
1	OUT	Output voltage of the LDO
2	GND	Common ground
3	IN	Input voltage of the LDO
TAB	GND	Common ground

**Table 3. Pin description (SOT-89, D configuration)**

Pin n°	Symbol	Function
1	GND	Common ground
2	IN	Input voltage of the LDO
3	OUT	Output voltage of the LDO
TAB	IN	Input voltage of the LDO

### 3 Typical application

**Figure 4. Typical application circuits**



*Note: Adjustable version and enable pin are not available on SOT-89 package.*

## 4 Maximum ratings

**Table 4. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{IN}$	DC input voltage	- 0.3 to 20	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
$V_{ADJ}$	ADJ pin voltage	- 0.3 to 2	V
$I_{OUT}$	Output current	Internally limited	mA
$P_D$ <sup>(1)</sup>	Power dissipation	Internally limited	mW
$T_{STG}$	Storage temperature range	- 65 to 150	°C
$T_{OP}$	Operating junction temperature range	- 40 to 125	°C

1. Maximum power dissipation must be calculated by taking into account the package and thermal performance.

**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 5. Thermal data**

Symbol	Parameter	SOT23-5L	SOT-89	Unit
$R_{thJA}$	Thermal resistance junction-ambient	160	110	°C/W
$R_{thJC}$	Thermal resistance junction-case	68	15	°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 6. LDK320 electrical characteristics (fixed output version)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{IN}$	Operating input voltage		2.5		18	V
$V_{OUT}$	$V_{OUT}$ accuracy	$T_J = 25\text{ °C}$	-2		2	%
		$-40\text{ °C} < T_J < 125\text{ °C}$	-3		3	%
	$V_{OUT}$ accuracy, LDK320A	$T_J = 25\text{ °C}$	-0.5		0.5	%
		$-40\text{ °C} < T_J < 125\text{ °C}$	-1.5		1.5	%
$\Delta V_{OUT}$	Static line regulation	$V_{OUT} + 1\text{ V} \leq V_{IN} \leq 18\text{ V}$		0.001	0.05	%/V
$\Delta V_{OUT}$	Static load regulation (SOT23-5L)	$I_{OUT} = 1\text{ mA to } 200\text{ mA}$ , $V_{OUT} \leq 2\text{ V}$		10	15	mV
		$I_{OUT} = 1\text{ mA to } 200\text{ mA}$ , $V_{OUT} > 2\text{ V}$		0.001	0.003	%/mA
$\Delta V_{OUT}$	Static load regulation (SOT-89)	$I_{OUT} = 1\text{ mA to } 200\text{ mA}$ , $V_{OUT} \leq 2\text{ V}$		10	25	mV
		$I_{OUT} = 1\text{ mA to } 200\text{ mA}$ , $V_{OUT} > 2\text{ V}$		0.001	0.004	%/mA
$V_{DROP}$	Dropout voltage <sup>(1)</sup>	$I_{OUT} = 100\text{ mA}$ , $V_{OUT} = 3.3\text{ V}$		100		
		$I_{OUT} = 200\text{ mA}$ , $V_{OUT} = 3.3\text{ V}$ $40\text{ °C} < T_J < 125\text{ °C}$		200	350	mV
$e_N$	Output noise voltage	10 Hz to 100 kHz, $I_{OUT} = 10\text{ mA}$		63		$\mu\text{V}_{RMS}/\text{V}$
SVR	Supply voltage rejection	$f = 120\text{ Hz}$ , $I_{OUT} = 10\text{ mA}$ , $V_{OUT} = 3.3\text{ V}$		88		dB
		$f = 1\text{ kHz}$ , $I_{OUT} = 10\text{ mA}$ , $V_{OUT} = 3.3\text{ V}$		65		
		$f = 10\text{ kHz}$ , $I_{OUT} = 10\text{ mA}$ , $V_{OUT} = 3.3\text{ V}$		48		
$I_Q$	Quiescent current	$V_{OUT} + 1\text{ V}$ , $V_{IN} 18\text{ V}$ , $I_{OUT} = 0\text{ mA}$ , $-40\text{ °C} < T_J < 125\text{ °C}$		60	90	$\mu\text{A}$
		$V_{IN} = V_{OUT} + 1\text{ V}$ , $I_{OUT} = 200\text{ mA}$ , $-40\text{ °C} < T_J < 125\text{ °C}$		70	100	
		$V_{IN}$ input current in OFF mode: $V_{EN} = G_{ND}$ , $T_J = 25\text{ °C}$		0.2	1	

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I <sub>SC</sub>	Short-circuit current	R <sub>L</sub> = 0		330		mA
		R <sub>L</sub> = 0, V <sub>IN</sub> = 16 V		200		
V <sub>EN</sub>	Enable input logic low	V <sub>IN</sub> = 2.5 V to 18 V, -40 °C < T <sub>J</sub> < 125 °C			0.4	V
	Enable input logic high	V <sub>IN</sub> = 2.5 V to 18 V, -40 °C < T <sub>J</sub> < 125 °C	1.2			
I <sub>EN</sub>	Enable pin input current	V <sub>EN</sub> = V <sub>IN</sub>		0.1	100	nA
T <sub>SHDN</sub>	Thermal shutdown			160		°C
	Hysteresis			20		
C <sub>OUT</sub>	Output capacitor	Capacitance (see Section 6 Typical characteristics)	1		22	μF

1. Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value.

T<sub>J</sub> = 25 °C, V<sub>IN</sub> = 2.5 V, C<sub>IN</sub> = C<sub>OUT</sub> = 1 μF, I<sub>OUT</sub> = 1 mA, V<sub>EN</sub> = V<sub>IN</sub>, unless otherwise specified.

**Table 7. LDK320 electrical characteristics (ADJ version)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{IN}$	Operating input voltage		2.5		18	V
$V_{ADJ}$	Adjustable voltage	$T_J = 25\text{ °C}$		1.185		V
	Adjustable voltage accuracy	$T_J = 25\text{ °C}$	-2		+2	%
		$40\text{ °C} < T_J < 125\text{ °C}$	-3		+3	
	Adjustable voltage, LDK320A	$T_J = 25\text{ °C}$		1.2		V
Adjustable voltage accuracy, LDK320A	$T_J = 25\text{ °C}$	-0.5		+0.5	%	
	$40\text{ °C} < T_J < 125\text{ °C}$	-1.5		+1.5		
$\Delta V_{OUT}$	Static line regulation	$V_{OUT} + 1\text{ V} \leq V_{IN} \leq 18\text{ V}$		0.001	0.05	%/V
$\Delta V_{OUT}$	Static load regulation	$I_{OUT} = 1\text{ mA to } 200\text{ mA}$		0.0002	0.003	%/mA
$V_{DROP}$	Dropout voltage <sup>(1)</sup>	$I_{OUT} = 100\text{ mA}, V_{OUT} = 3.3\text{ V}$		100		mV
		$I_{OUT} = 200\text{ mA}, V_{OUT} = 3.3\text{ V}$ $40\text{ °C} < T_J < 125\text{ °C}$		200	350	
$e_N$	Output noise voltage	10 Hz to 100 kHz $I_{OUT} = 10\text{ mA}$		60		$\mu\text{V}_{RMS}$
$I_{ADJ}$	Adjust pin current				1	$\mu\text{A}$
SVR	Supply voltage rejection	$f = 120\text{ Hz } I_{OUT} = 10\text{ mA},$ $V_{OUT} = V_{ADJ}$		83		dB
		$f = 1\text{ kHz } I_{OUT} = 10\text{ mA},$ $V_{OUT} = V_{ADJ}$		73		
		$f = 10\text{ kHz } I_{OUT} = 10\text{ mA},$ $V_{OUT} = V_{ADJ}$		58		
$I_Q$	Quiescent current	$V_{OUT} + 1\text{ V} \leq V_{IN} \leq 18\text{ V},$ $I_{OUT} = 0\text{ mA},$ $-40\text{ °C} < T_J < 125\text{ °C}$		50	90	$\mu\text{A}$
		$V_{IN} = V_{OUT} + 1\text{ V},$ $I_{OUT} = 200\text{ mA},$ $-40\text{ °C} < T_J < 125\text{ °C}$		60	100	
		$V_{IN}$ input current in OFF mode: $V_{EN} = \text{GND}, T_J = 25\text{ °C}$		0.2	1	
$I_{SC}$	Short-circuit current	$R_L = 0$		330		mA
		$R_L = 0, V_{IN} = 16\text{ V}$		200		
$V_{EN}$	Enable input logic low	$V_{IN} = 2.5\text{ V to } 18\text{ V},$ $-40\text{ °C} < T_J < 125\text{ °C}$			0.4	V
	Enable input logic high	$V_{IN} = 2.5\text{ V to } 18\text{ V},$ $-40\text{ °C} < T_J < 125\text{ °C}$	1.2			
$I_{EN}$	Enable pin input current	$V_{EN} = V_{IN}$		0.1	100	nA
$T_{SHDN}$	Thermal shutdown			160		$\text{°C}$
	Hysteresis			20		

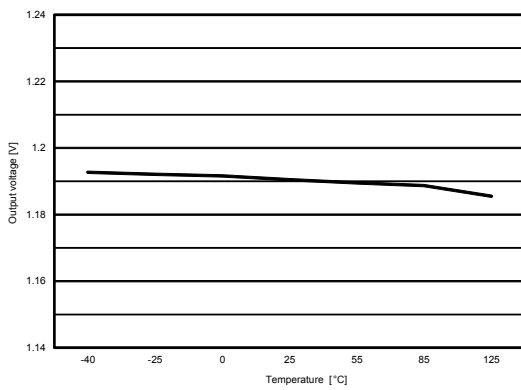


Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C <sub>OUT</sub>	Output capacitor	Capacitance (see <a href="#">Section 6 Typical characteristics</a> )	1		22	μF

## 6 Typical characteristics

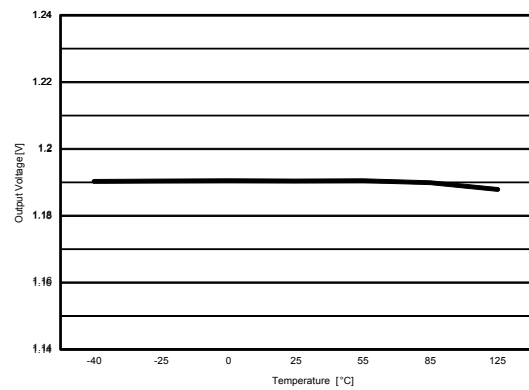
Unless otherwise specified:  $T_J = 25\text{ }^\circ\text{C}$ ,  $V_{IN} = V_{OUT(NOM)} + 1\text{ V}$ ,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ .

**Figure 5. Output voltage vs. temperature ( $V_{IN} = 2.5\text{ V}$ ,  $V_{OUT} = V_{ADJ}$ ,  $I_{OUT} = 1\text{ mA}$ )**



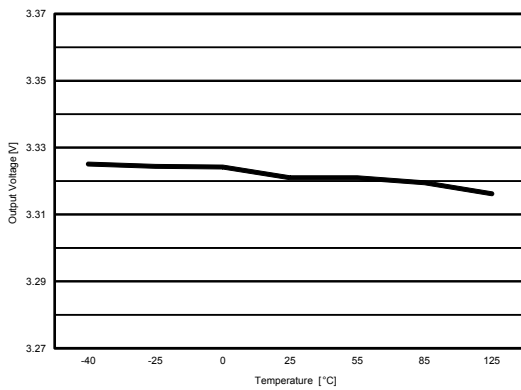
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**Figure 6. Output voltage vs. temperature ( $V_{IN} = 2.5\text{ V}$ ,  $V_{OUT} = V_{ADJ}$ ,  $I_{OUT} = 200\text{ mA}$ )**



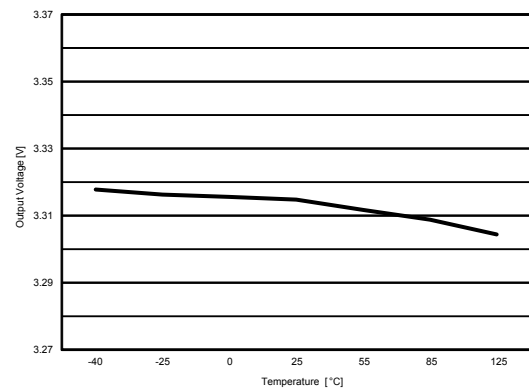
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**Figure 7. Output voltage vs. temperature ( $V_{IN} = 4.3\text{ V}$ ,  $V_{OUT} = 3.3\text{ V}$ ,  $I_{OUT} = 1\text{ mA}$ )**



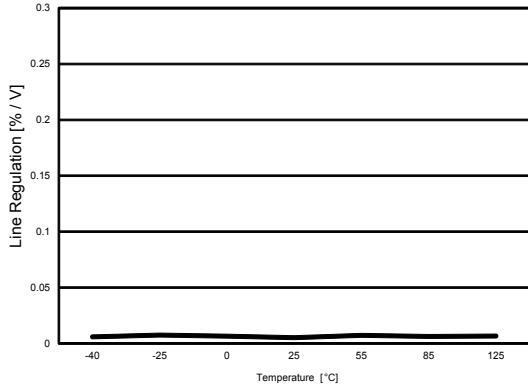
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**Figure 8. Output voltage vs. temperature ( $V_{IN} = 4.3\text{ V}$ ,  $V_{OUT} = 3.3\text{ V}$ ,  $I_{OUT} = 200\text{ mA}$ )**



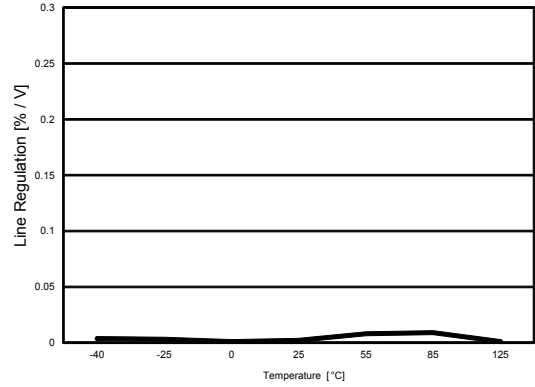
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**Figure 9. Line regulation vs. temperature ( $V_{IN} = 4.3$  to  $18$  V,  $V_{OUT} = 3.3$  V,  $I_{OUT} = 1$  mA)**



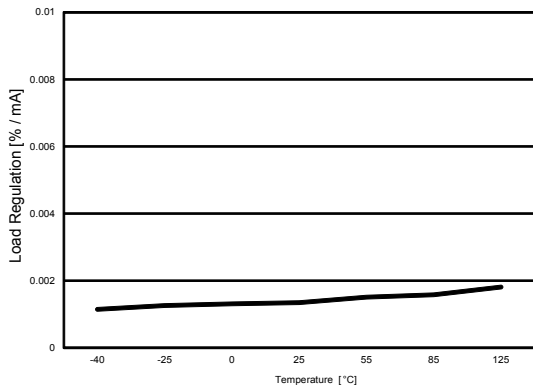
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**Figure 10. Line regulation vs. temperature ( $V_{IN} = 2.5$  to  $18$  V,  $V_{OUT} = V_{ADJ}$ ,  $I_{OUT} = 1$  mA)**



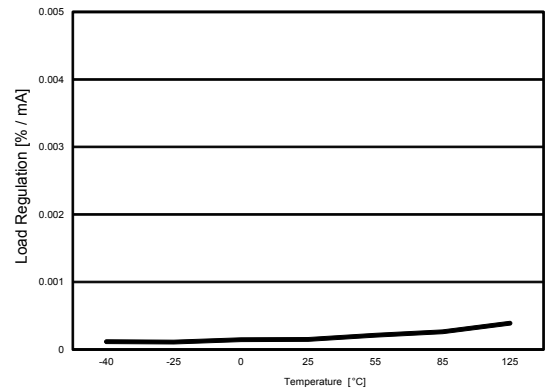
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**Figure 11. Load regulation vs. temperature ( $V_{IN} = 4.3$  V,  $V_{OUT} = 3.3$  V,  $I_{OUT} = 1$  to  $200$  mA)**



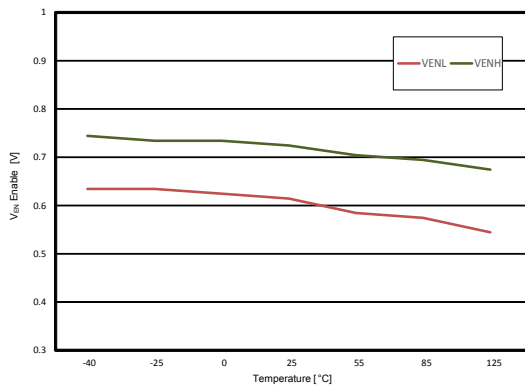
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**Figure 12. Load regulation vs. temperature ( $V_{IN} = 2.5$  V,  $V_{OUT} = V_{ADJ}$ ,  $I_{OUT} = 1$  to  $200$  mA)**



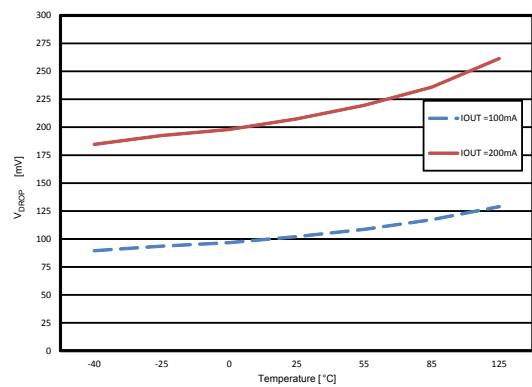
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**Figure 13. Enable thresholds vs. temperature ( $I_{OUT} = 1$  mA)**



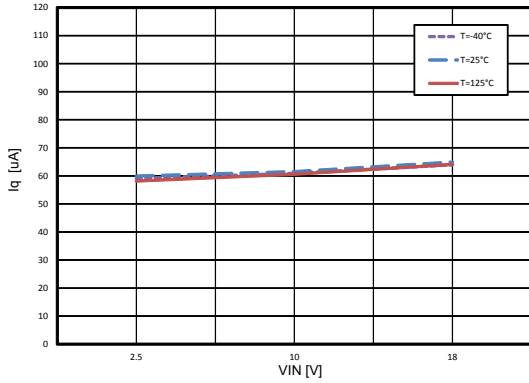
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**Figure 14. Dropout voltage vs. temperature**



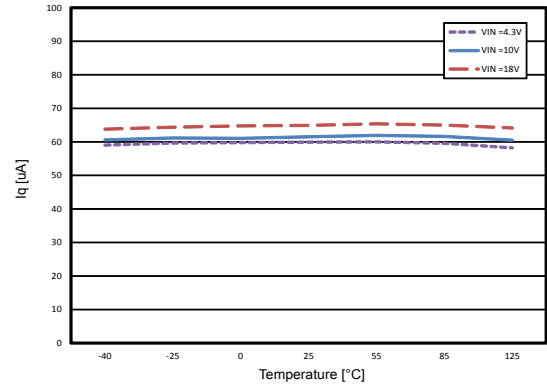
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Figure 15. Quiescent current vs. input voltage ( $I_{OUT} = 1 \text{ mA}$ )



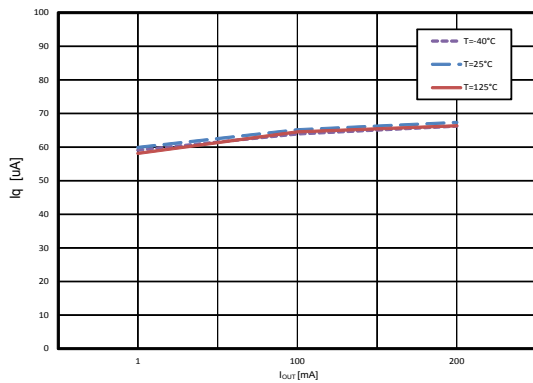
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Figure 16. Quiescent current vs. temperature ( $I_{OUT} = 1 \text{ mA}$ )



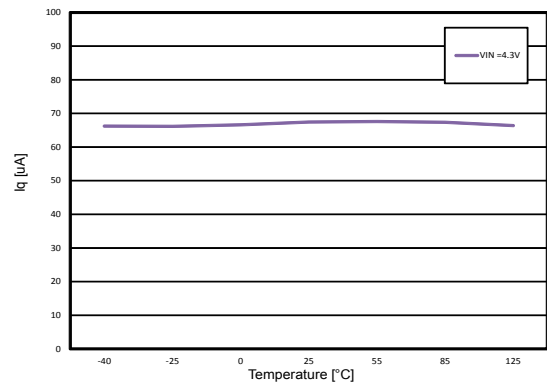
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Figure 17. Quiescent current vs. output current ( $V_{IN} = 4.3 \text{ V}$ )



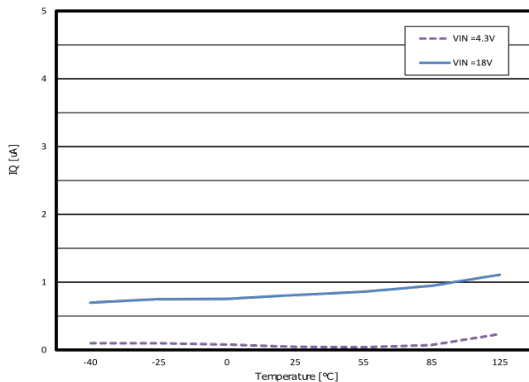
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Figure 18. Quiescent current vs. temperature ( $I_{OUT} = 200 \text{ mA}$ )



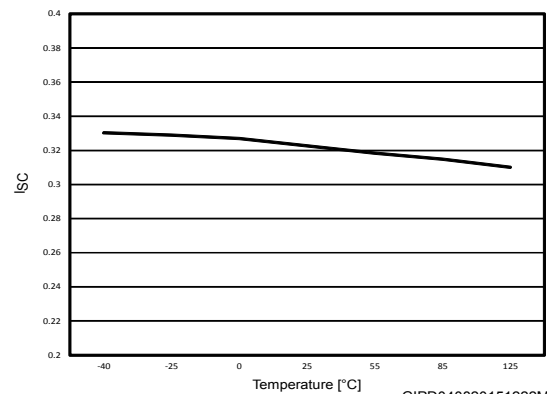
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Figure 19. Off-state current vs. temperature



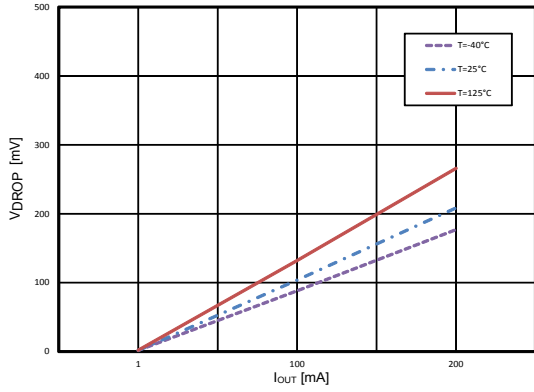
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Figure 20. Short-circuit current vs. temperature ( $V_{IN} = 4.3 \text{ V}$ )



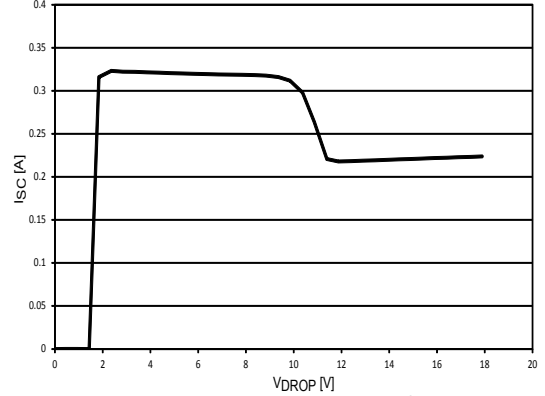
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**Figure 21. Dropout voltage vs.  $I_{OUT}$**



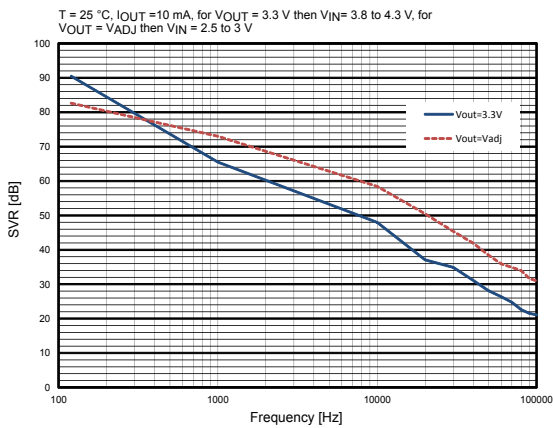
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**Figure 22. Short-circuit current vs. drop voltage**



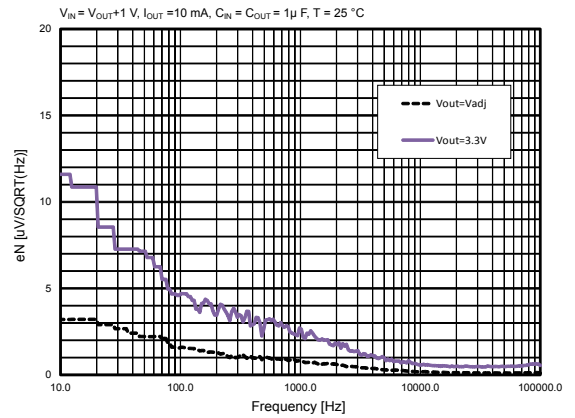
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**Figure 23. SVR vs. frequency**



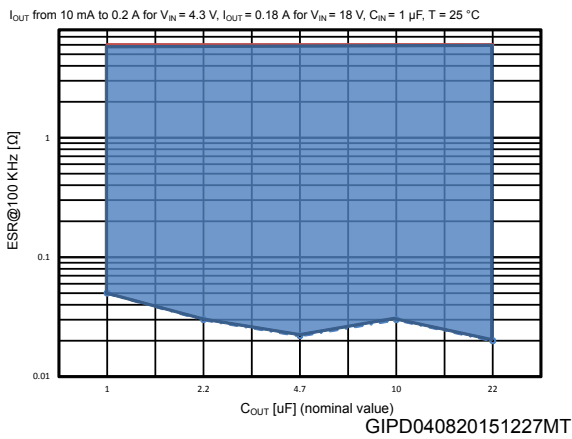
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**Figure 24. Output noise spectral density**



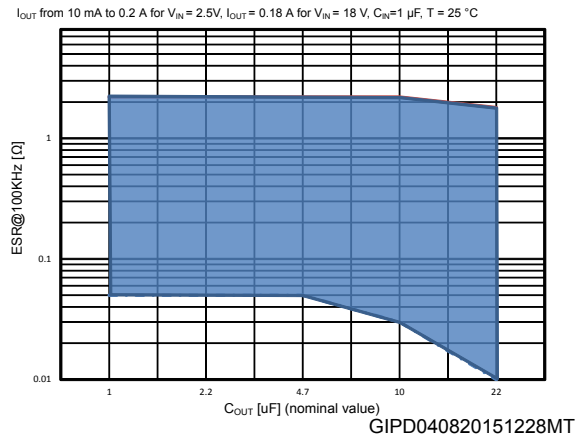
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**Figure 25. Stability plan ( $V_{OUT} = 3.3\text{ V}$ )**



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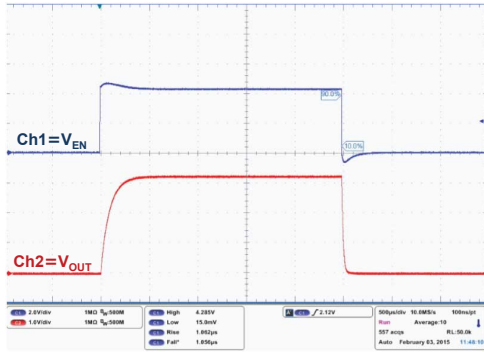
**Figure 26. Stability plan ( $V_{OUT} = V_{ADJ}$ )**



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**Figure 27. Startup with enable ( $V_{OUT} = 3.3\text{ V}$ )**

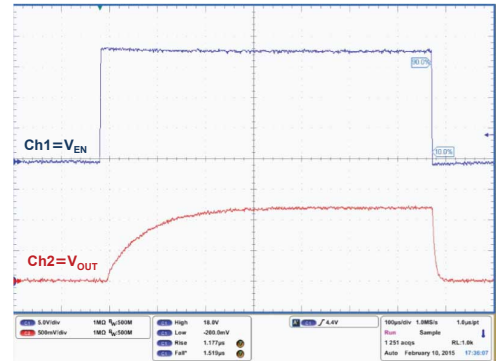
$V_{IN} = 4.3\text{ V}$ ,  $V_{EN}$  = from 0 to  $V_{IN}$ ,  $I_{OUT} = 200\text{ mA}$ ,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$   $t_{rise} = t_{fall} = 1\text{ }\mu\text{s}$



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**Figure 28. Startup with enable ( $V_{OUT} = V_{ADJ}$ )**

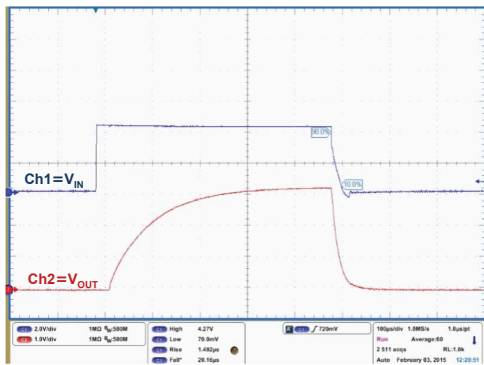
$V_{IN} = 18\text{ V}$ ,  $V_{EN}$  = from 0 to  $V_{IN}$ ,  $I_{OUT} = 200\text{ mA}$ ,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$   $t_{rise} = t_{fall} = 1\text{ }\mu\text{s}$



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**Figure 29. Turn-on time ( $V_{OUT} = 3.3\text{ V}$ )**

$V_{IN} = V_{EN}$  = from 0 to 4.3 V,  $I_{OUT} = 200\text{ mA}$ ,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ ,  $T_{rise} = 1\text{ }\mu\text{s}$



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**Figure 30. Turn-on time ( $V_{OUT} = V_{ADJ}$ )**

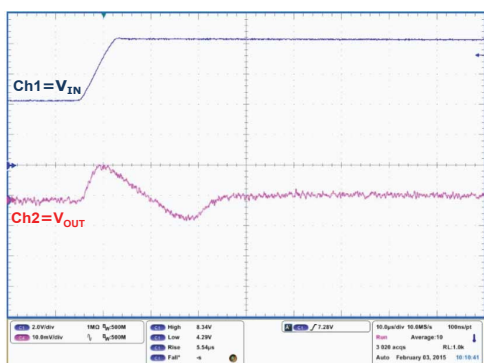
$V_{IN} = V_{EN}$  = from 0 to 18 V,  $I_{OUT} = 200\text{ mA}$ ,  $V_{OUT} = V_{REF}$ ,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ ,  $T_{rise} = 5\text{ }\mu\text{s}$



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**Figure 31. Line transient ( $V_{OUT} = 3.3\text{ V}$ , rise)**

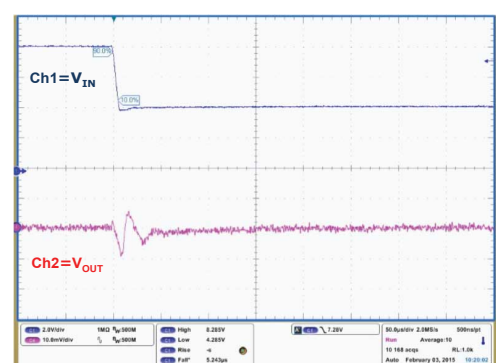
$V_{IN} = V_{EN}$  = from 4.3 to 8.3 V,  $I_{OUT} = 10\text{ mA}$ ,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ ,  $T_{rise} = 5\text{ }\mu\text{s}$



GIPD040820151233MT

**Figure 32. Line transient ( $V_{OUT} = 3.3\text{ V}$ , fall)**

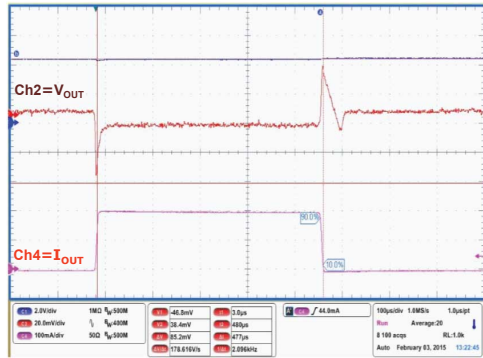
$V_{IN} = V_{EN}$  = from 4.3 to 8.3 V,  $I_{OUT} = 10\text{ mA}$ ,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ ,  $T_{fall} = 5\text{ }\mu\text{s}$



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**Figure 33. Load transient ( $V_{OUT} = 3.3\text{ V}$ , rise)**

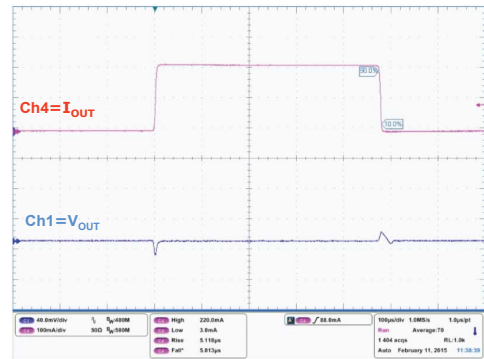
$V_{IN} = V_{EN} = 4.3\text{ V}$ ,  $I_{OUT}$  = from 1 to 200 mA,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$   $T_{rise} = 5\text{ }\mu\text{s}$



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**Figure 34. Load transient ( $V_{OUT} = V_{ADJ}$ , fall)**

$V_{IN} = V_{EN} = 2.5\text{ V}$ ,  $I_{OUT}$  = from 1 to 200 mA,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$   $T_{rise} - T_{fall} = 5\text{ }\mu\text{s}$



GIPD040820151237bMT

## 7 Package information

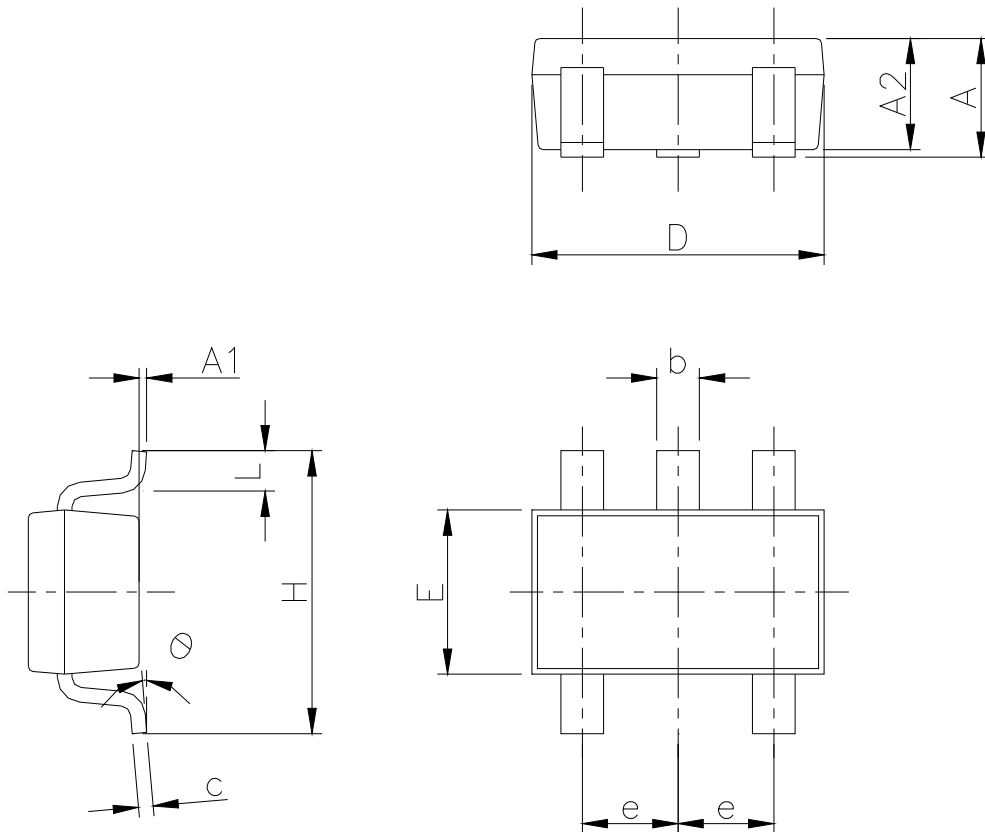
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In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.



## 7.1 SOT23-5L package information

Figure 35. SOT23-5L package outline

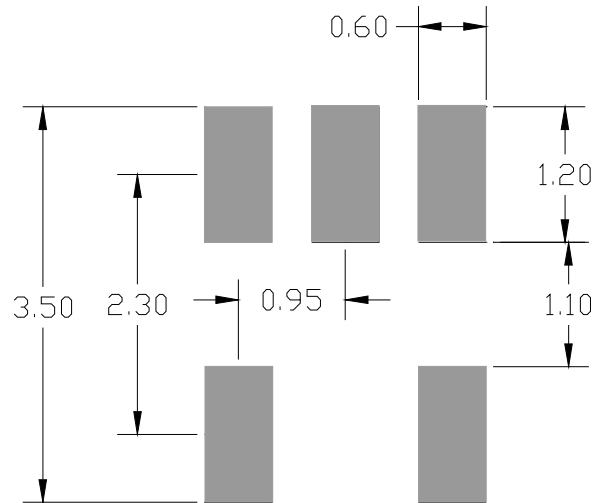


7049676\_k

Table 8. SOT23-5L package mechanical data

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

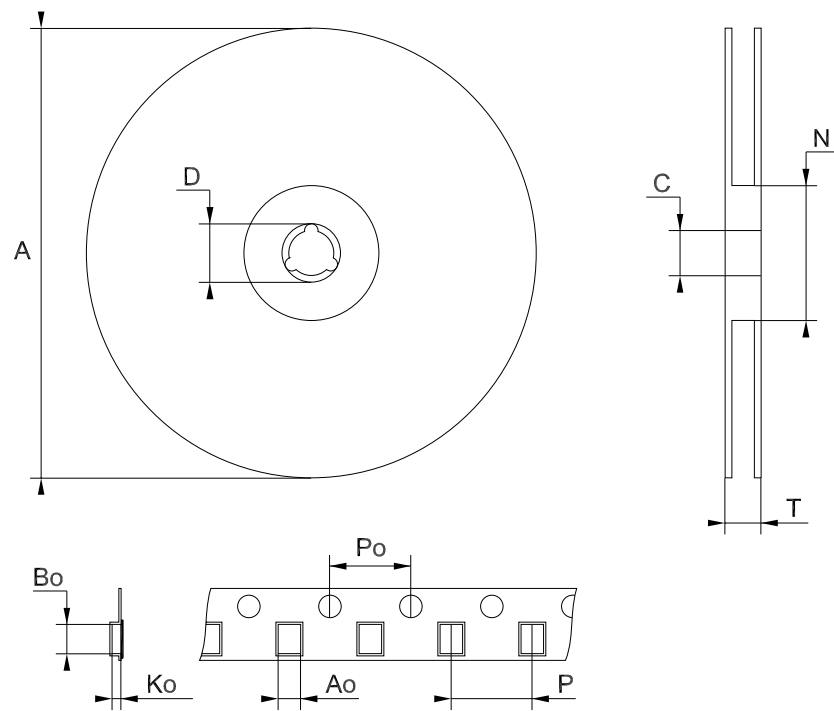
Figure 36. SOT23-5L recommended footprint



Note: Dimensions are in mm

## 7.2 SOT23-5L packing information

Figure 37. SOT23-5L tape and reel outline



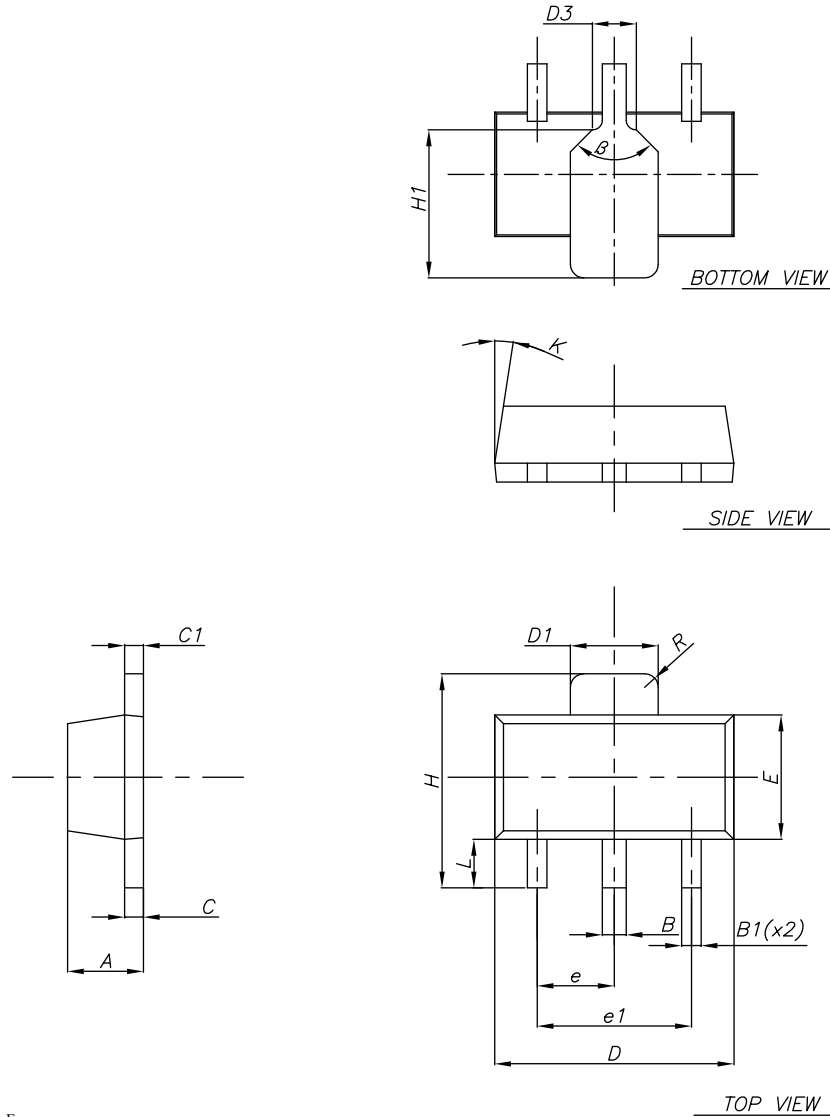
Note: Drawing not in scale

**Table 9. SOT23-5L tape and reel mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A			180
C	12.8	13.0	13.2
D	20.2		
N	60		
T			14.4
Ao	3.13	3.23	3.33
Bo	3.07	3.17	3.27
Ko	1.27	1.37	1.47
Po	3.9	4.0	4.1
P	3.9	4.0	4.1

### 7.3 SOT-89 package information

Figure 38. SOT-89 package outline

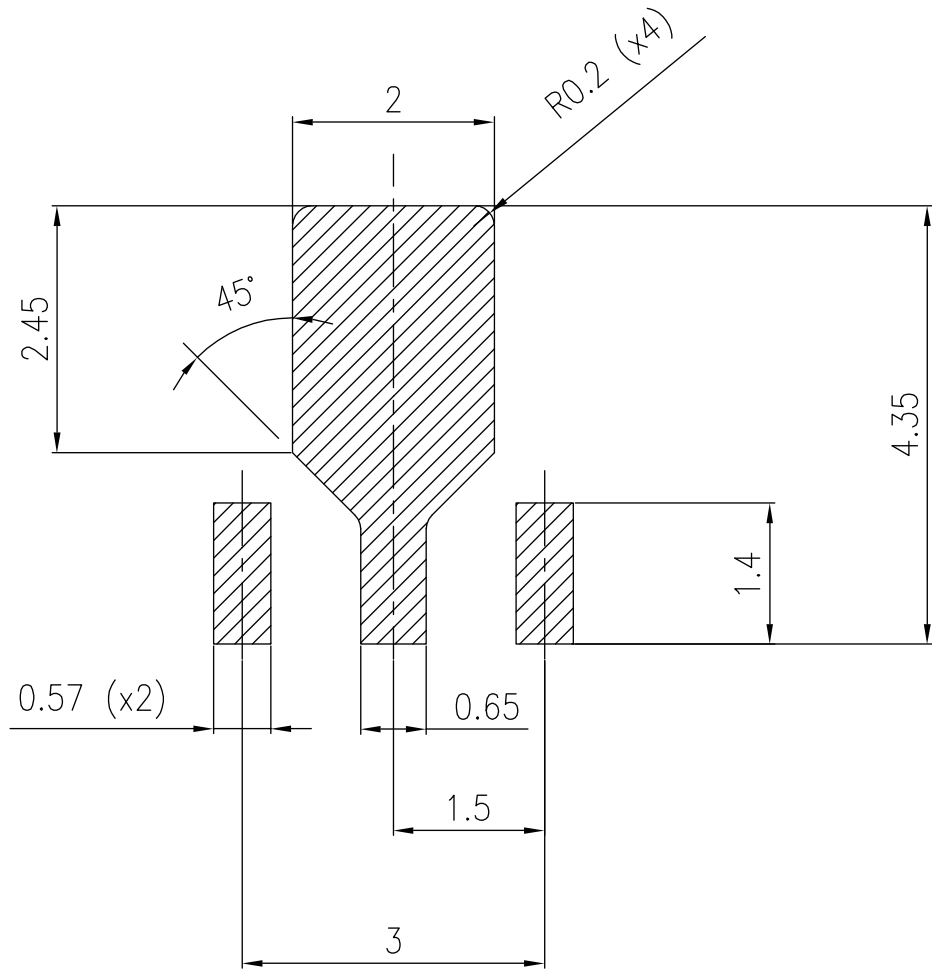


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**Table 10. SOT-89 mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	1.40		1.60
B	0.44		0.56
B1	0.36		0.48
C	0.35		0.44
C1	0.35		0.44
D	4.40		4.60
D1	1.62		1.83
D3		0.90	
E	2.29		2.60
e	1.42		1.57
e1	2.92		3.07
H	3.94		4.25
H1	2.70		3.10
K	1°		8°
L	0.89		120
R		0.25	
β		90°	

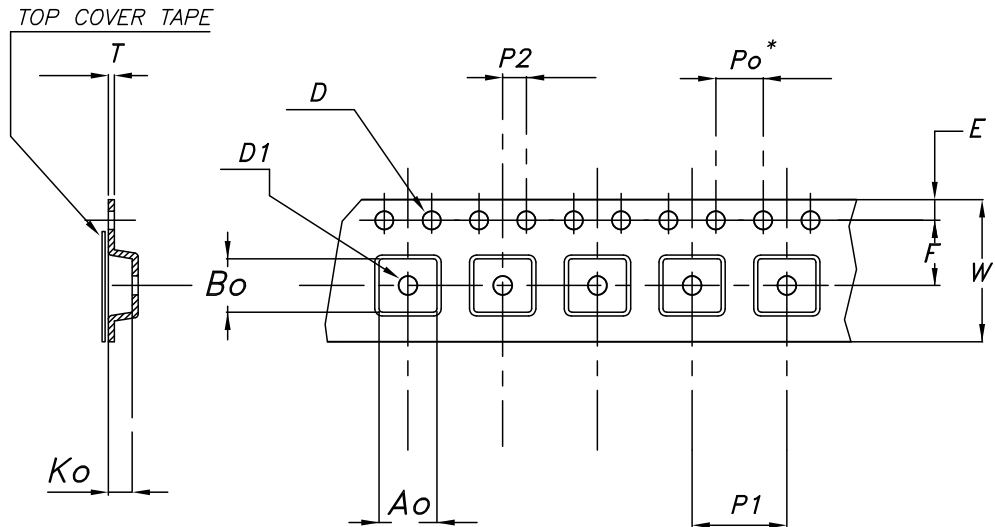
Figure 39. SOT-89 recommended footprint



Footprint

## 7.4 SOT-89 packing information

Figure 40. SOT-89 carrier tape outline



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Table 11. SOT-89 carrier tape mechanical data

Dim.	mm	
	Value	Tolerance
Ao	4.91	± 0.10
Bo	4.52	± 0.10
Ko	1.90	± 0.10
F	5.50	± 0.10
E	1.75	± 0.10
W	12	± 0.30
P2	2	± 0.10
Po	4	± 0.10
P1	8	± 0.10
T	0.30	± 0.10
D	∅ 1.55	± 0.05
D1	∅ 1.60	± 0.10

## 8 Ordering information

**Table 12. Order code**

SOT23-5L	SOT-89 (D configuration)	SOT-89	Marking	Accuracy (%)	Output voltage
LDK320AM-R			ADA	0.5	ADJ
LDK320M-R			KAD	2	
LDK320AM12R <sup>(1)</sup>				0.5	1.2
LDK320M12R <sup>(1)</sup>				2	
LDK320AM15R <sup>(1)</sup>			15A	0.5	1.5
LDK320AM18R <sup>(1)</sup>			18A	0.5	1.8
LDK320M18R			K18	2	
LDK320AM25R			25A	0.5	2.5
LDK320M25R			K25	2	
LDK320AM30R			30A	0.5	3
	LDK320ADU30R		30	0.5	
LDK320M30R			K30	2	
LDK320AM33R			33A	0.5	3.3
	LDK320ADU33R		33	0.5	
LDK320M33R			K33	2	
LDK320AM36R			36A	0.5	3.6
LDK320AM50R			50A	0.5	5
	LDK320ADU50R		50	0.5	
		LDK320AU50R	E0	0.5	
LDK320M50R			K50	2	
LDK320AM120R			120A	0.5	12
	LDK320ADU120R		A2	0.5	
LDK320M120R <sup>(1)</sup>				2	

1. Available on request.



## Revision history

**Table 13. Document revision history**

Date	Revision	Changes
16-Nov-2015	1	First release.
01-Jun-2016	2	Document status promoted from preliminary data to production data. Updated title and features in cover page. Updated Section 8: "Ordering information". Minor text changes.
05-Jul-2017	3	Updated Section 8: "Ordering information". Minor text changes.
09-Oct-2018	4	Updated $\Delta V_{OUT}$ test condition in Table 6. LDK320 electrical characteristics (fixed output version). Added new order code LDK320AU50R in Table 12. Order code.
28-Oct-2019	5	Added $\Delta V_{OUT}$ for SOT-89 in Table 6. LDK320 electrical characteristics (fixed output version).
23-Jul-2020	6	Updated Figure 2. Block diagram (adjustable version).
10-Nov-2020	7	Updated Table 12. Order code.
12-Nov-2020	8	Added new Marking column in Table 12. Order code.

## 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</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 characteristics</b> .....	<b>10</b>
<b>7</b>	<b>Package information</b> .....	<b>16</b>
7.1	SOT23-5L package information.....	17
7.2	SOT23-5L packing information .....	18
7.3	SOT-89 package information .....	20
7.4	SOT-89 packing information .....	23
<b>8</b>	<b>Ordering information</b> .....	<b>24</b>
	<b>Revision history</b> .....	<b>25</b>
	<b>Contents</b> .....	<b>26</b>
	<b>List of tables</b> .....	<b>27</b>
	<b>List of figures</b> .....	<b>28</b>

## List of tables

<b>Table 1.</b>	Pin description (SOT23-5L) . . . . .	3
<b>Table 2.</b>	Pin description (SOT-89) . . . . .	3
<b>Table 3.</b>	Pin description (SOT-89, D configuration) . . . . .	3
<b>Table 4.</b>	Absolute maximum ratings . . . . .	5
<b>Table 5.</b>	Thermal data . . . . .	5
<b>Table 6.</b>	LDK320 electrical characteristics (fixed output version) . . . . .	6
<b>Table 7.</b>	LDK320 electrical characteristics (ADJ version) . . . . .	8
<b>Table 8.</b>	SOT23-5L package mechanical data . . . . .	17
<b>Table 9.</b>	SOT23-5L tape and reel mechanical data . . . . .	19
<b>Table 10.</b>	SOT-89 mechanical data . . . . .	21
<b>Table 11.</b>	SOT-89 carrier tape mechanical data . . . . .	23
<b>Table 12.</b>	Order code . . . . .	24
<b>Table 13.</b>	Document revision history . . . . .	25

## List of figures

<b>Figure 1.</b>	Block diagram (fixed version) . . . . .	2
<b>Figure 2.</b>	Block diagram (adjustable version) . . . . .	2
<b>Figure 3.</b>	Pin connection (top view) . . . . .	3
<b>Figure 4.</b>	Typical application circuits . . . . .	4
<b>Figure 5.</b>	Output voltage vs. temperature ( $V_{IN} = 2.5\text{ V}$ , $V_{OUT} = V_{ADJ}$ , $I_{OUT} = 1\text{ mA}$ ) . . . . .	10
<b>Figure 6.</b>	Output voltage vs. temperature ( $V_{IN} = 2.5\text{ V}$ , $V_{OUT} = V_{ADJ}$ , $I_{OUT} = 200\text{ mA}$ ) . . . . .	10
<b>Figure 7.</b>	Output voltage vs. temperature ( $V_{IN} = 4.3\text{ V}$ , $V_{OUT} = 3.3\text{ V}$ , $I_{OUT} = 1\text{ mA}$ ) . . . . .	10
<b>Figure 8.</b>	Output voltage vs. temperature ( $V_{IN} = 4.3\text{ V}$ , $V_{OUT} = 3.3\text{ V}$ , $I_{OUT} = 200\text{ mA}$ ) . . . . .	10
<b>Figure 9.</b>	Line regulation vs. temperature ( $V_{IN} = 4.3\text{ to }18\text{ V}$ , $V_{OUT} = 3.3\text{ V}$ , $I_{OUT} = 1\text{ mA}$ ) . . . . .	11
<b>Figure 10.</b>	Line regulation vs. temperature ( $V_{IN} = 2.5\text{ to }18\text{ V}$ , $V_{OUT} = V_{ADJ}$ , $I_{OUT} = 1\text{ mA}$ ) . . . . .	11
<b>Figure 11.</b>	Load regulation vs. temperature ( $V_{IN} = 4.3\text{ V}$ , $V_{OUT} = 3.3\text{ V}$ , $I_{OUT} = 1\text{ to }200\text{ mA}$ ) . . . . .	11
<b>Figure 12.</b>	Load regulation vs. temperature ( $V_{IN} = 2.5\text{ V}$ , $V_{OUT} = V_{ADJ}$ , $I_{OUT} = 1\text{ to }200\text{ mA}$ ) . . . . .	11
<b>Figure 13.</b>	Enable thresholds vs. temperature ( $I_{OUT} = 1\text{ mA}$ ) . . . . .	11
<b>Figure 14.</b>	Dropout voltage vs. temperature . . . . .	11
<b>Figure 15.</b>	Quiescent current vs. input voltage ( $I_{OUT} = 1\text{ mA}$ ) . . . . .	12
<b>Figure 16.</b>	Quiescent current vs. temperature ( $I_{OUT} = 1\text{ mA}$ ) . . . . .	12
<b>Figure 17.</b>	Quiescent current vs. output current ( $V_{IN} = 4.3\text{ V}$ ) . . . . .	12
<b>Figure 18.</b>	Quiescent current vs. temperature ( $I_{OUT} = 200\text{ mA}$ ) . . . . .	12
<b>Figure 19.</b>	Off-state current vs. temperature . . . . .	12
<b>Figure 20.</b>	Short-circuit current vs. temperature ( $V_{IN} = 4.3\text{ V}$ ) . . . . .	12
<b>Figure 21.</b>	Dropout voltage vs. $I_{OUT}$ . . . . .	13
<b>Figure 22.</b>	Short-circuit current vs. drop voltage . . . . .	13
<b>Figure 23.</b>	SVR vs. frequency . . . . .	13
<b>Figure 24.</b>	Output noise spectral density . . . . .	13
<b>Figure 25.</b>	Stability plan ( $V_{OUT} = 3.3\text{ V}$ ) . . . . .	13
<b>Figure 26.</b>	Stability plan ( $V_{OUT} = V_{ADJ}$ ) . . . . .	13
<b>Figure 27.</b>	Startup with enable ( $V_{OUT} = 3.3\text{ V}$ ) . . . . .	14
<b>Figure 28.</b>	Startup with enable ( $V_{OUT} = V_{ADJ}$ ) . . . . .	14
<b>Figure 29.</b>	Turn-on time ( $V_{OUT} = 3.3\text{ V}$ ) . . . . .	14
<b>Figure 30.</b>	Turn-on time ( $V_{OUT} = V_{ADJ}$ ) . . . . .	14
<b>Figure 31.</b>	Line transient ( $V_{OUT} = 3.3\text{ V}$ , rise) . . . . .	14
<b>Figure 32.</b>	Line transient ( $V_{OUT} = 3.3\text{ V}$ , fall) . . . . .	14
<b>Figure 33.</b>	Load transient ( $V_{OUT} = 3.3\text{ V}$ , rise) . . . . .	15
<b>Figure 34.</b>	Load transient ( $V_{OUT} = V_{ADJ}$ , fall) . . . . .	15
<b>Figure 35.</b>	SOT23-5L package outline . . . . .	17
<b>Figure 36.</b>	SOT23-5L recommended footprint . . . . .	18
<b>Figure 37.</b>	SOT23-5L tape and reel outline . . . . .	18
<b>Figure 38.</b>	SOT-89 package outline . . . . .	20
<b>Figure 39.</b>	SOT-89 recommended footprint . . . . .	22
<b>Figure 40.</b>	SOT-89 carrier tape outline . . . . .	23

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