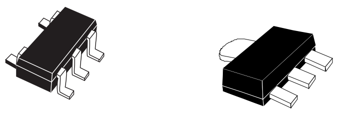
LDK320

200 mA low quiescent current and high PSRR voltage regulator

Datasheet - preliminary data



SOT23-5L SOT-89

Features

- Input voltage from 2.5 to 18 V
- Very low-dropout voltage (100 mV typ. @ 100 mA load)
- Low quiescent current (typ. 60 µA, 1 µA in off mode)
- High PSRR: 88 dB@120 Hz
- Low noise
- Output voltage tolerance: ± 2.0% @ 25 °C; (±0.5% version available on request)
- 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 µF
- Current, SOA and thermal protections
- Available in SOT23-5L and SOT-89 packages
- Temperature range: -40 °C to 125 °C

Applications

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

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 µA.

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

Contents

1 Diagram

Figure 1: Block diagram (fixed version)

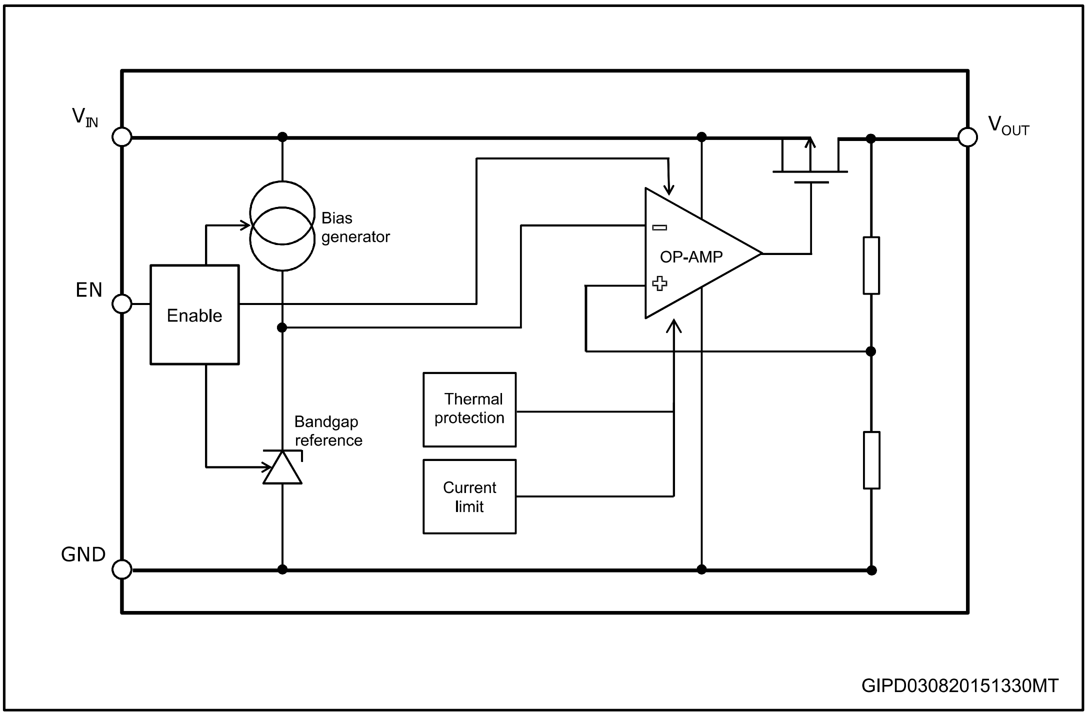
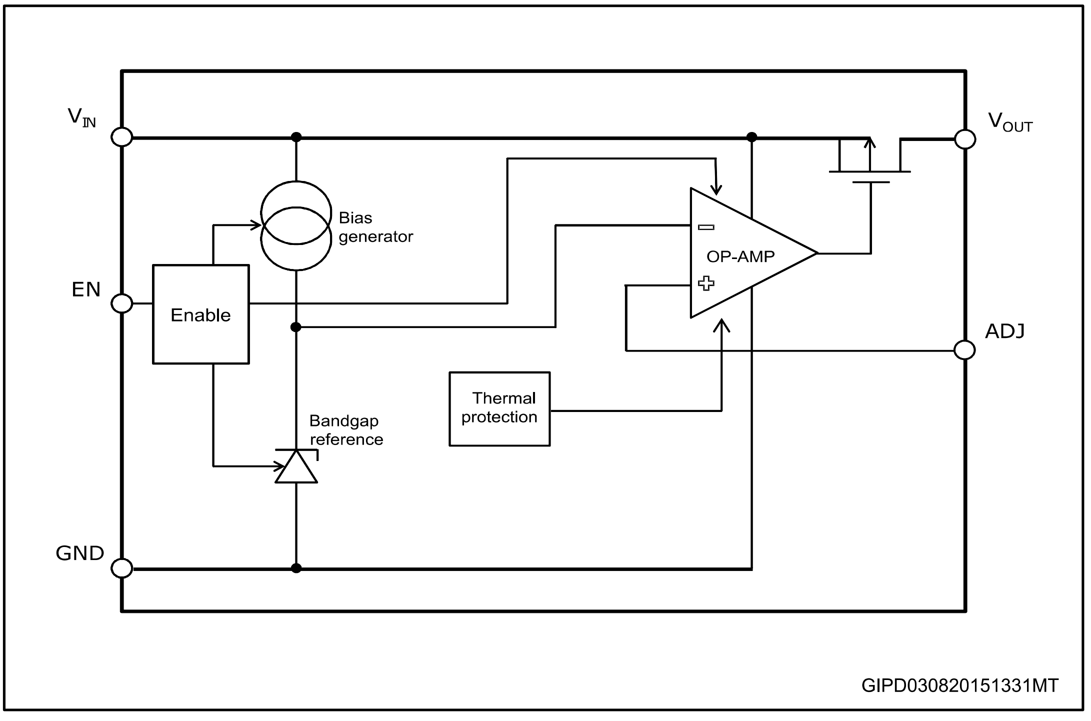


Figure 2: Block diagram (adjustable version)



2 Pin configuration

Figure 3: Pin connection (top view)

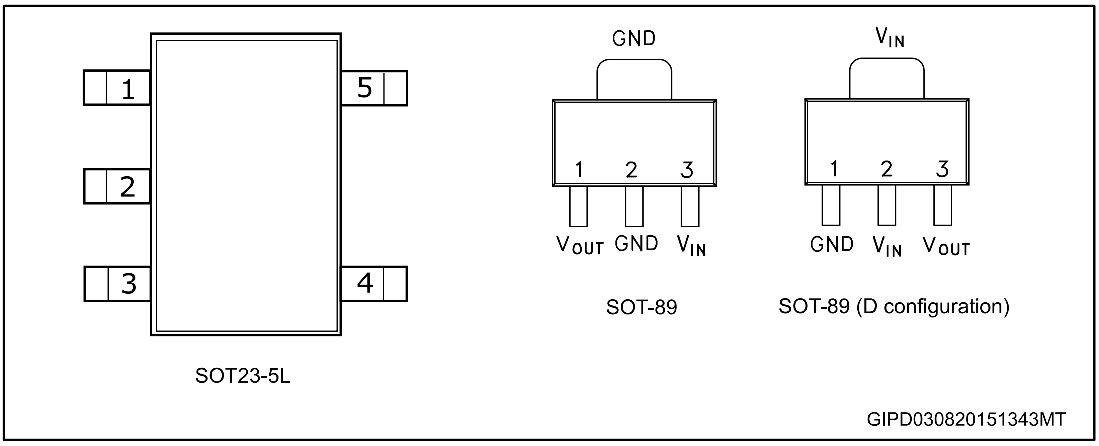


Table 1: Pin description (SOT23-5L)

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)

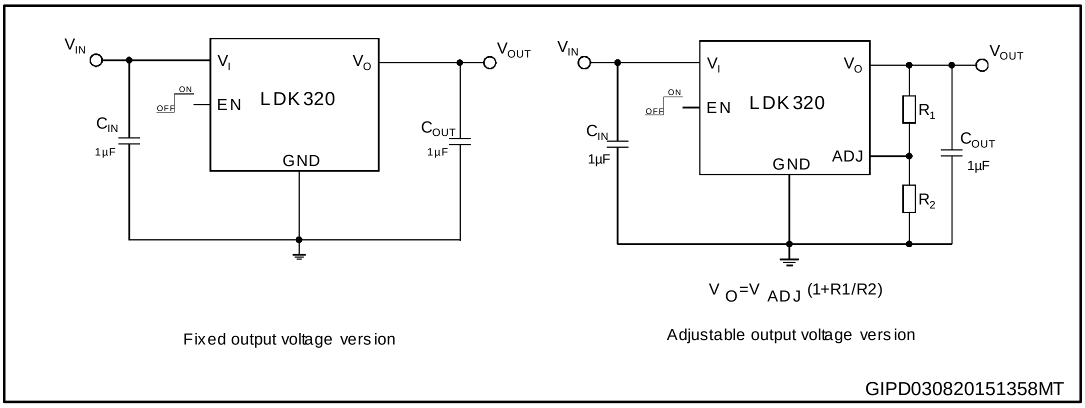
Pin n°	Symbol	Function
1	OUT	Output voltage of the LDO
2	GND	Common ground
3	IN	Input voltage of the LDO
TAB	GND	Common ground

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



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

4 Maximum ratings

Table 4: Absolute maximun 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(1)	Power dissipation	Internally limited	mW
T_{STG}	Storage temperature range	- 65 to 150	°C
T_{OP}	Operating junction temperature range	- 40 to 125	°C

Notes:

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

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 °C, V_{IN} = $V_{OUT(NOM)}$ + 1 V, C_{IN} = C_{OUT} = 1 µF, I_{OUT} = 1 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 °C	-2		2	%
		-40 °C < T_J < 125 °C	-3		3	%
	V_{OUT} accuracy, LDK320A	T_J = 25 °C	-0.5		0.5	%
		-40 °C < T_J < 125 °C	-1.5		1.5	%
V_{OUT}	Static line regulation	V_{OUT} +1 V V_{IN} 18 V		0.001	0.05	%/V
V_{OUT}	Static load regulation	I_{OUT} = 1mA to 200 mA		0.001	0.003	%/mA
V_{DROP}	Dropout voltage [(1)]	I_{OUT} = 100 mA, V_{OUT} = 3.3 V		100		
		I_{OUT} = 200 mA V = 3.3 V 40 °C < T_J < 125 °C		200	350	mV
e_N	Output noise voltage	10 Hz to 100 kHz I_{OUT} = 10 mA		63		µV_{RMS}/V
SVR	Supply voltage rejection	f = 120 Hz I_{OUT} = 10 mA V_{OUT} = 3.3 V		88		
		f = 1 kHz I_{OUT} = 10 mA V_{OUT} = 3.3 V		65		
		f = 10 kHz I_{OUT}= 10 mA V_{OUT} = 3.3 V		48		dB
I_Q	Quiescent current	V_{OUT} +1 V V_{IN} 18 V I_{OUT} = 0 mA -40 °C < T_J < 125 °C		60	90	µA
		V_{IN} = V_{OUT} +1 V I_{OUT} = 200 mA -40 °C < T_J < 125 °C		70	100	
		V_{IN} input current in OFF mode: V_{EN} = G_{ND} T_J = 25 °C		0.2	1	
I_{SC}	Short-circuit current	R_L = 0		330		mA
		R_L = 0, V_{IN} = 16 V		200		
V_{EN}	Enable input logic low	V_{IN} = 2.5 V to 18 V -40 °C < T_J < 125 °C			0.4	V
	Enable input logic high	V_{IN} = 2.5 V to 18 V -40 °C < T_J < 125 °C	1.2			

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{EN}	Enable pin input current	$V_{EN} = V_{IN}$		0.1	100	nA
T_{SHDN}	Thermal shutdown			160		°C
	Hysteresis			20		
C_{OUT}	Output capacitor	Capacitance (see *Section 6: "Typical characteristics"*)	1		22	µF

Notes:

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

T_J = 25 °C, V_{IN} = 2.5 V, C_{IN} = C_{OUT} = 1 µF, I_{OUT} = 1 mA, V_{EN} = V_{IN}, 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 °C		1.185		V
	Adjustable voltage accuracy	T_J = 25 °C	-2		+2	%
		40 °C < T_J < 125 °C	-3		+3	
	Adjustable voltage, LDK320A	T_J = 25 °C		1.2		V
	Adjustable voltage accuracy, LDK320A	T_J = 25 °C	-0.5		+0.5	%
		40 °C < T_J <125 °C	-1.5		+1.5	
ΔV_{OUT}	Static line regulation	V_{OUT} + 1 V ≤ V_{IN} ≤ 18 V		0.001	0.05	%/V
ΔV_{OUT}	Static load regulation	I_{OUT} = 1 mA to 200 mA		0.0002	0.003	%/mA
V_{DROP}	Dropout voltage (1)	I_{OUT} = 100 mA V_{OUT} = 3.3 V		100		mV
		I_{OUT} = 200 mA V_{OUT} = 3.3 V 40 °C < T_J < 125 °C		200	350	
e_N	Output noise voltage	10 Hz to 100 kHz I_{OUT} = 10 mA		60		μV_{RMS}
I_{ADJ}	Adjust pin current				1	µA
SVR	Supply voltage rejection	f = 120 Hz I_{OUT} = 10 mA V_{OUT} = V_{ADJ}		83		dB
		f = 1 kHz I_{OUT} = 10 mA V_{OUT} = V_{ADJ}		73		
		f = 10 kHz I_{OUT} = 10 mA V_{OUT} = V_{ADJ}		58		

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_Q	Quiescent current	V_{OUT} +1 V ≤ V_{IN} ≤ 18 V I_{OUT} = 0 mA -40 °C < T_J < 125 °C		50	90	µA
		V_{IN} = V_{OUT} + 1 V I_{OUT} = 200 mA -40 °C < T_J < 125 °C		60	100	
		V_{IN} input current in OFF mode: V_{EN} = GND T_J = 25 °C		0.2	1	
I_{SC}	Short-circuit current	R_L = 0		330		mA
		R_L = 0, V_{IN} = 16 V		200		
V_{EN}	Enable input logic low	V_{IN} = 2.5 V to 18 V -40 °C < T_J < 125 °C			0.4	V
	Enable input logic high	V_{IN} = 2.5 V to 18 V -40 °C < T_J < 125 °C	1.2			
I_{EN}	Enable pin input current	V_{EN} = V_{IN}		0.1	100	nA
T_{SHDN}	Thermal shutdown			160		°C
	Hysteresis			20		
C_{OUT}	Output capacitor	Capacitance (see *Section 6: "Typical characteristics"*)	1		22	µF

6 Typical characteristics

Unless otherwise specified: T_J = 25 °C, V_{IN} = $V_{OUT(NOM)}$ + 1 V, C_{IN} = C_{OUT} = 1 µF.

Figure 5: Output voltage vs temperature (V_{IN} = 2.5 V, V_{OUT} = V_{ADJ}, I_{OUT} = 1 mA)

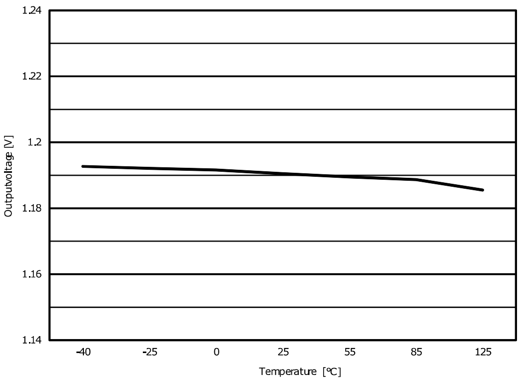


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Figure 6: Output voltage vs temperature (V_{IN} = 2.5 V, V_{OUT} = V_{ADJ}, I_{OUT} = 200 mA)

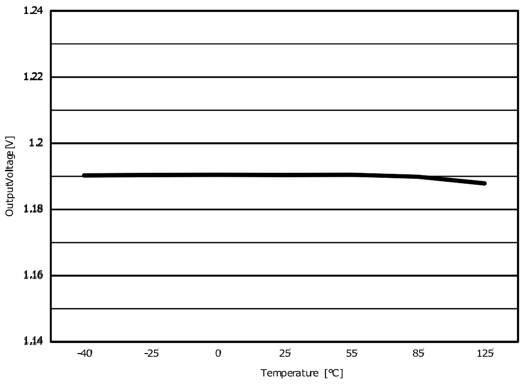

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Figure 7: Output voltage vs temperature (V_{IN} = 4.3 V, V_{OUT} = 3.3 V, I_{OUT} = 1 mA)

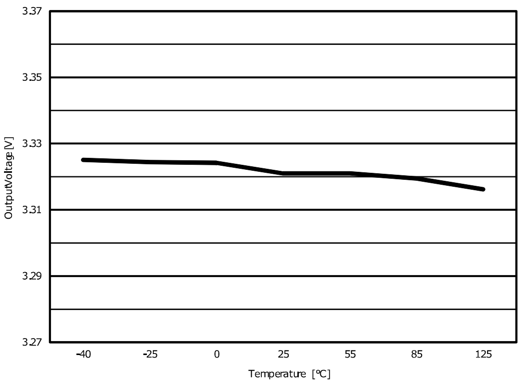

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Figure 8: Output voltage vs temperature (V_{IN} = 4.3 V, V_{OUT} = 3.3 V, I_{OUT} = 200 mA)

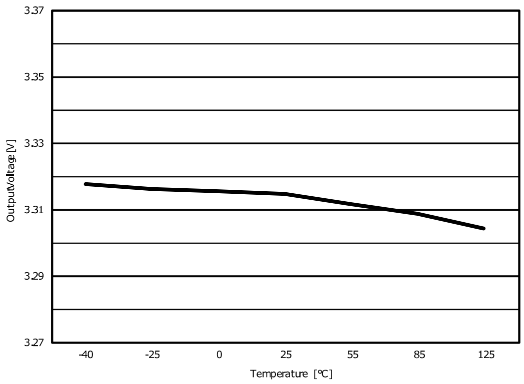

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Figure 9: Line regulation vs temperature (V_{IN} = 4.3 to 18 V, V_{OUT} = 3.3 V, I_{OUT} = 1 mA)

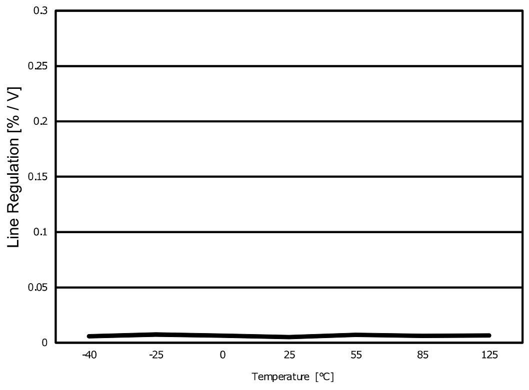

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Figure 10: Line regulation vs temperature (V_{IN} = 2.5 to 18 V, V_{OUT} = V_{ADJ}, I_{OUT} = 1 mA)

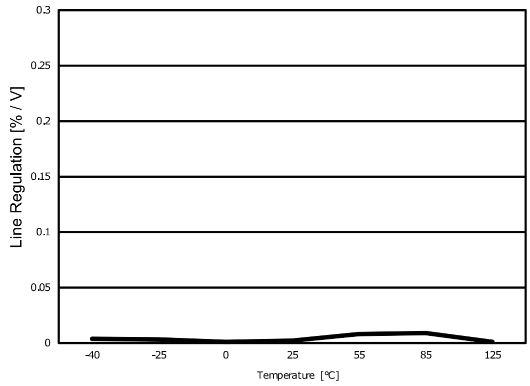

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Figure 11: Load regulation vs temperature (V_{IN} = 4.3 V, V_{OUT} = 3.3 V, I_{OUT} = 1 to 200 mA)

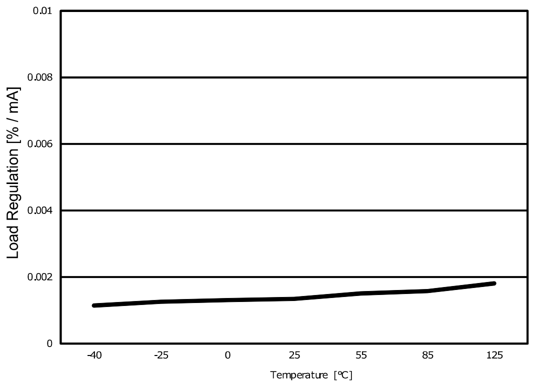

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Figure 12: Load regulation vs temperature (V_{IN} = 2.5 V, V_{OUT} = V_{ADJ}, I_{OUT} = 1 to 200 mA)

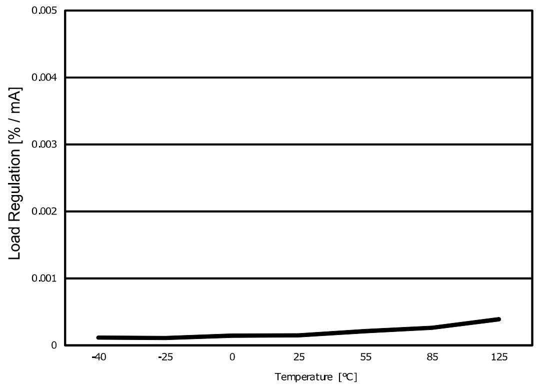

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Figure 13: Enable thresholds vs temperature (I_{OUT} = 1 mA)

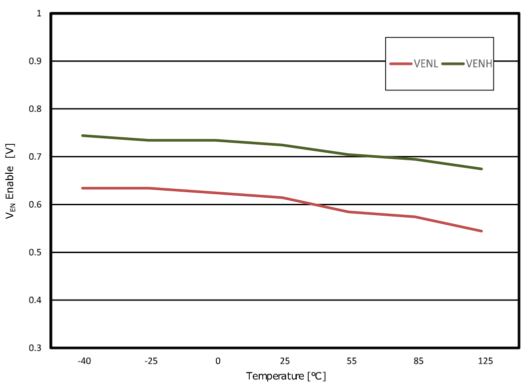

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Figure 14: Dropout voltage vs temperature

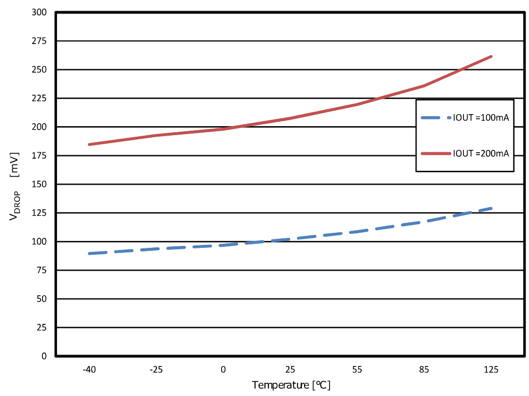

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Figure 15: Quiescent current vs input voltage (I_{OUT} = 1 mA)

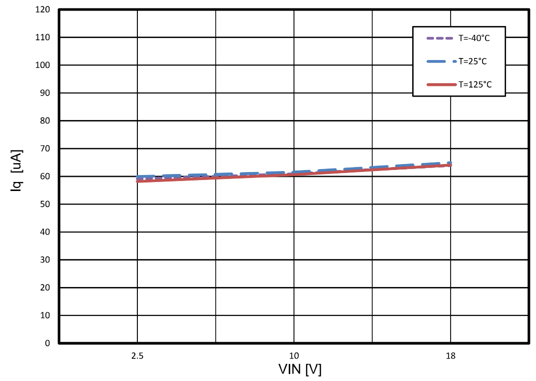

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Figure 16: Quiescent current vs temperature (I_{OUT} = 1 mA)

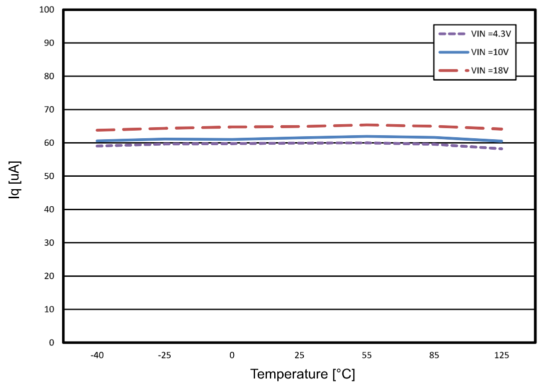

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Figure 17: Quiescent current vs output current (V_{IN} = 4.3 V)

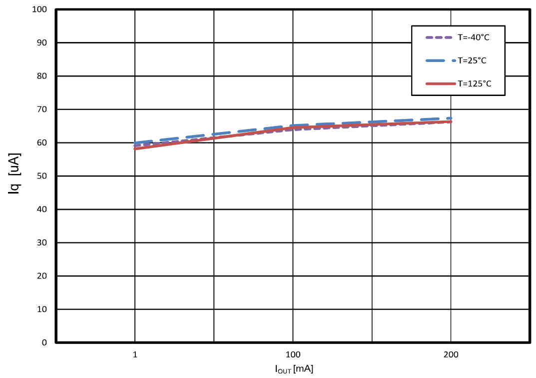

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Figure 18: Quiescent current vs temperature (I_{OUT} = 200 mA)

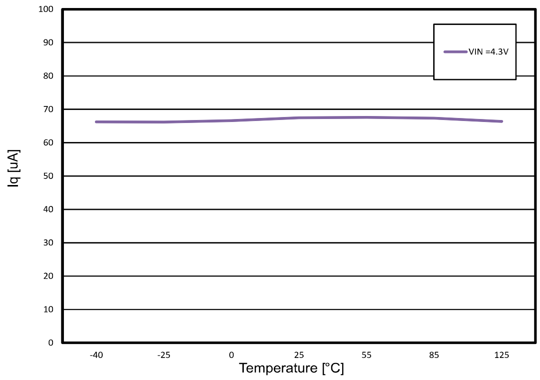

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Figure 19: Off-state current vs temperature

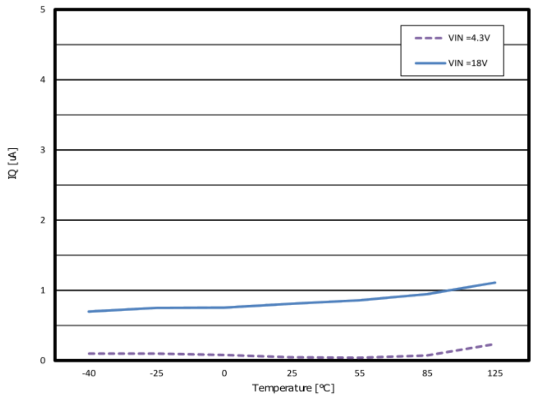

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Figure 20: Short-circuit current vs temperature (V_{IN} = 4.3 V)

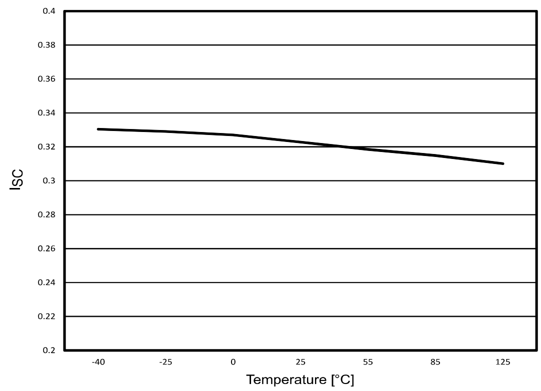

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Figure 21: Dropout voltage vs I_{OUT}

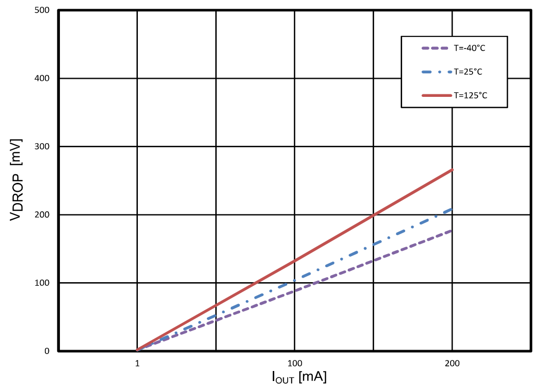

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Figure 22: Short-cicuit current vs drop voltage

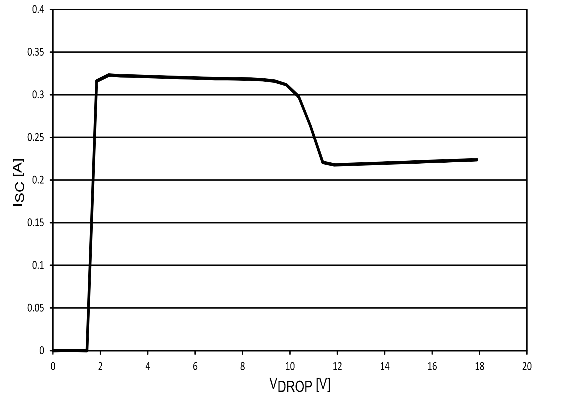

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Figure 23: SVR vs frequency

T = 25 °C, I_{OUT} =10 mA, for V_{OUT} = 3.3 V then V_{IN}= 3.8 to 4.3 V, for V_{OUT} = V_{ADJ} then V_{IN} = 2.5 to 3 V

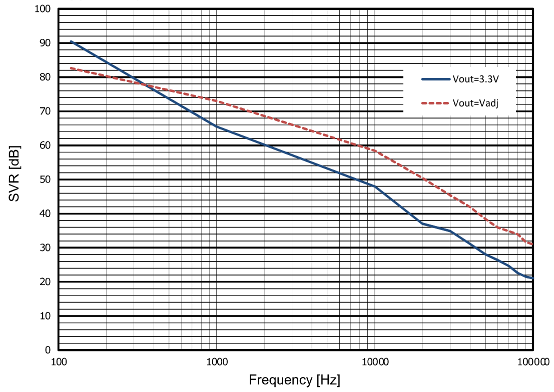

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Figure 24: Output noise spectral density

V_{IN} = V_{OUT}+1 V, I_{OUT} =10 mA, C_{IN} = C_{OUT} = 1μ F, T = 25 °C

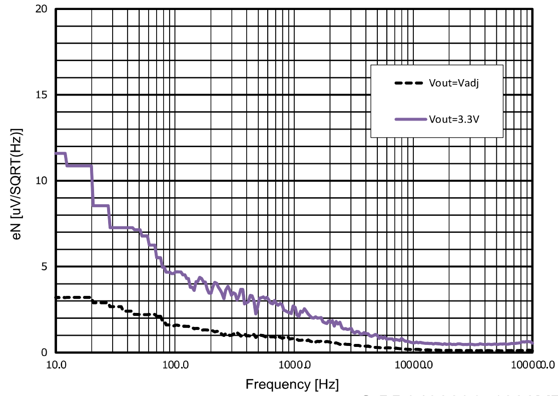

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Figure 25: Stability plan (V_{OUT} = 3.3 V)

I_{OUT} from 10 mA to 0.2 A for V_{IN} = 4.3 V, I_{OUT} = 0.18 A for V_{IN} = 18 V, C_{IN} = 1 μF, T = 25 °C

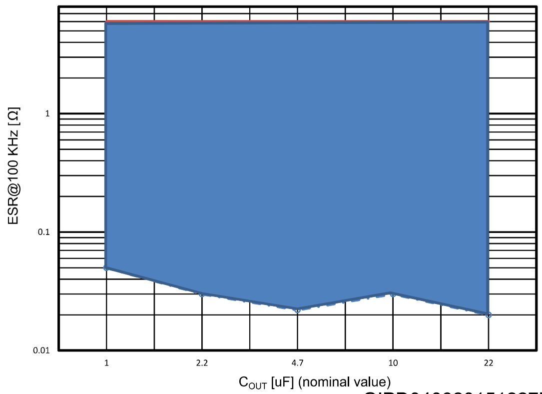

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Figure 26: Stability plan (V_{OUT} = V_{ADJ})

I_{OUT} from 10 mA to 0.2 A for V_{IN} = 2.5V, I_{OUT} = 0.18 A for V_{IN} = 18 V, C_{IN}=1 μF, T = 25 °C

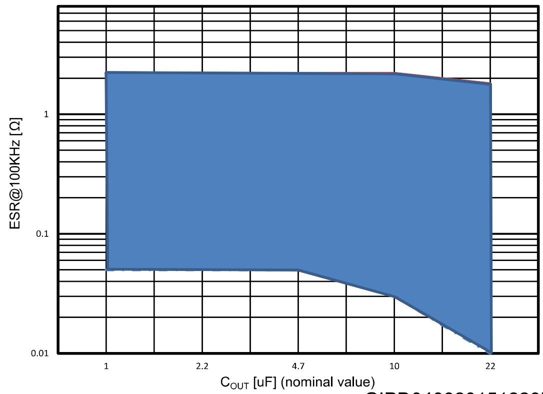

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Figure 27: Startup with enable (V_{OUT} = 3.3 V)

VIN = 4.3 V, VEN = from 0 to Vin, IOUT = 200 mA, CIN = COUT = 1 µF trise = tfall = 1 µs

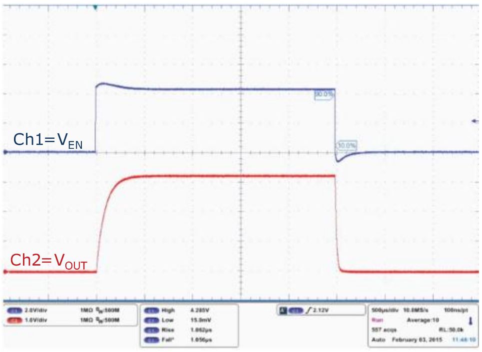

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Figure 28: Startup with enable (V_{OUT} = V_{ADJ})

V_{IN} = 18 V, V_{EN} = from 0 to V_{in}, I_{OUT} =200 mA, C_{IN} = C_{OUT} =1 µF trise = t_{fall} = 1 µs

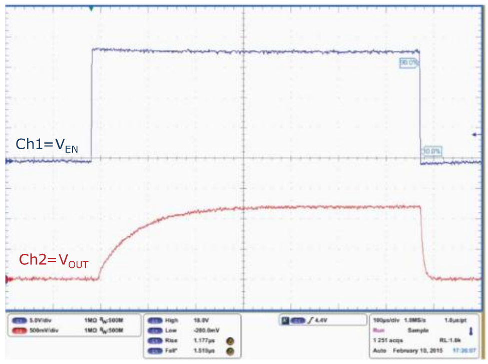

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Figure 29: Turn-on time (V_{OUT} = 3.3 V)

V_{IN} = V_{EN} = from 0 to 4.3 V, I_{OUT} = 200 mA, C_{IN} = C_{OUT} = 1 µF, T_{rise} = 1 µs

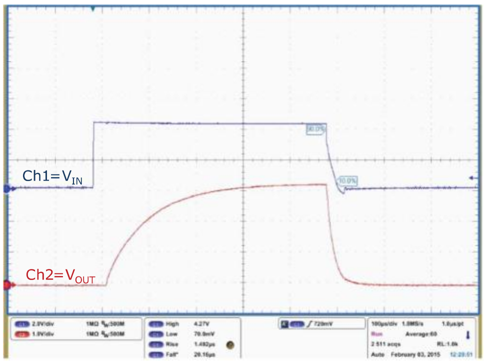

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Figure 30: Turn-on time (V_{OUT} = V_{ADJ})

V_{IN} = V_{EN} = from 0 to 18 V, I_{OUT} = 200 mA V_{OUT} = V_{REF}, C_{IN} = C_{OUT} = 1 µF T_{rise} = 5 µs

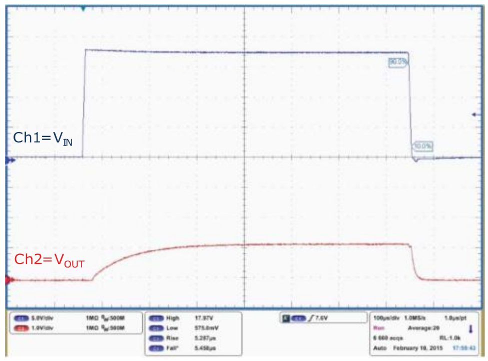

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Figure 31: Line transient (V_{OUT} = 3.3 V, rise)

V_{IN} = V_{EN} = from 4.3 to 8.3 V, I_{OUT} = 10 mA, C_{IN} = C_{OUT} = 1 µF T_{rise} = 5 µs

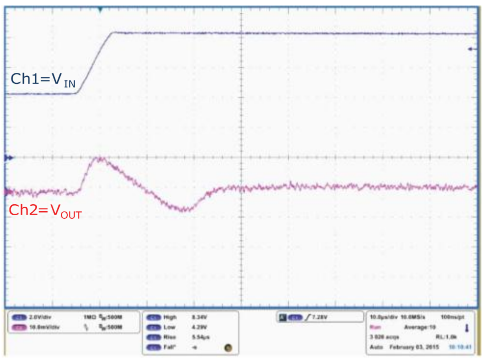

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Figure 32: Line transient (V_{OUT} = 3.3 V, fall)

V_{IN} = V_{EN} = from 4.3 to 8.3 V, I_{OUT} =10 mA, C_{IN} = C_{OUT} =1 µF T_{fall} = 5 µs

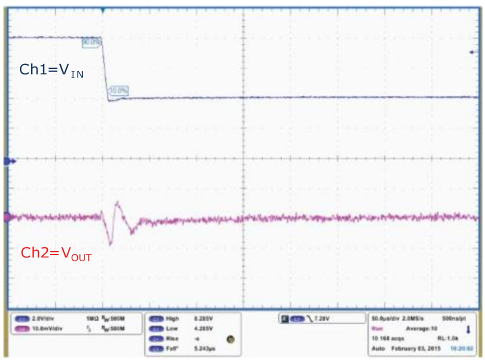

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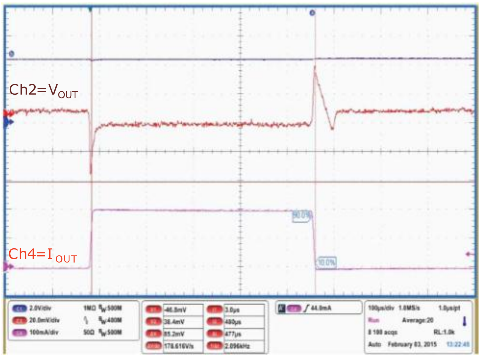
Figure 33: Load transient (V_{OUT} = 3.3 V, rise)

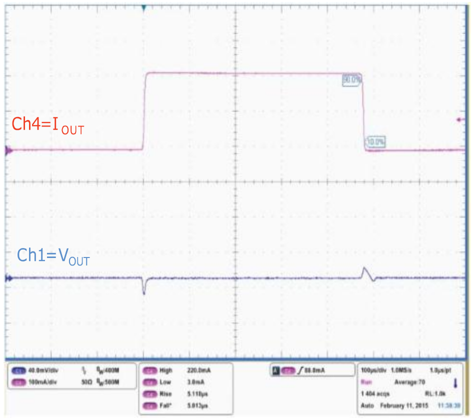
$V_{IN} = V_{EN}$ = 4.3 V, I_{OUT} = from 1 to 200 mA, $C_{IN} = C_{OUT}$ = 1 μF T_{rise} = 5 μs



GIPD040820151236MT

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

$V_{IN} = V_{EN}$ = 2.5 V, I_{OUT} = from 1 to 200 mA, $C_{IN} = C_{OUT}$ = 1 μF T_{rise} - T_{fall} = 5 μs



GIPD040820151237bMT

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***. ECOPACK® is an ST trademark.

7.1 SOT23-5L package outline

Figure 35: SOT23-5L package outline

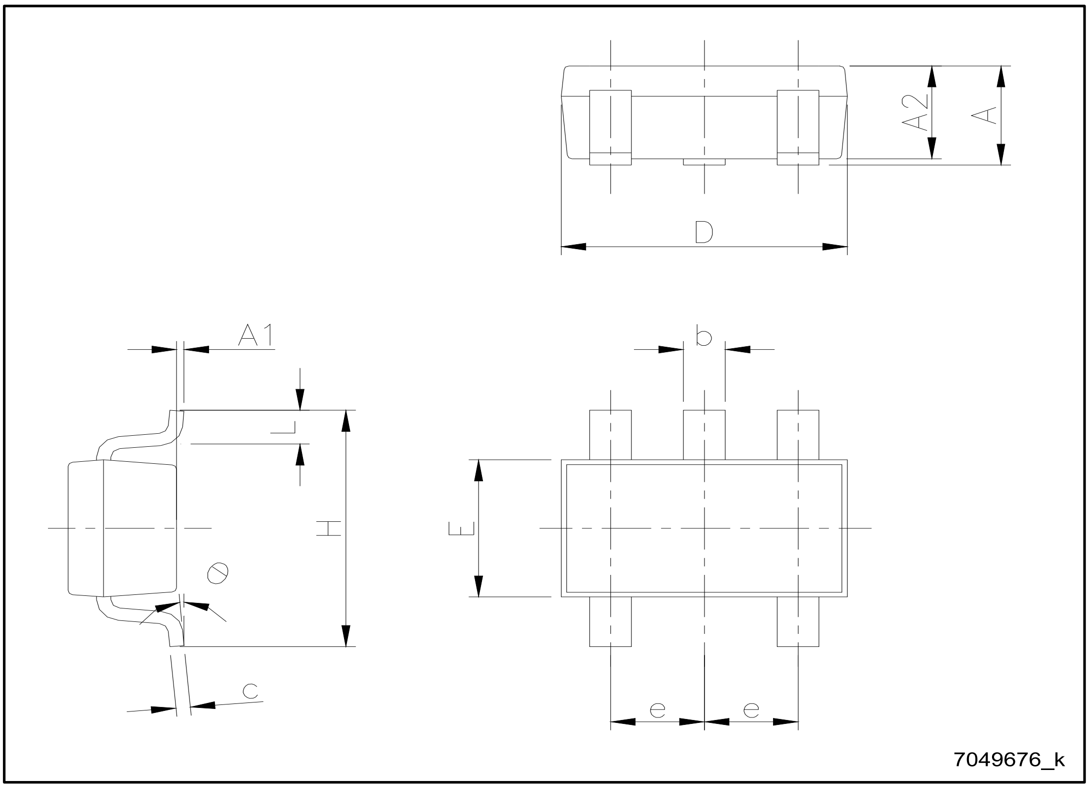
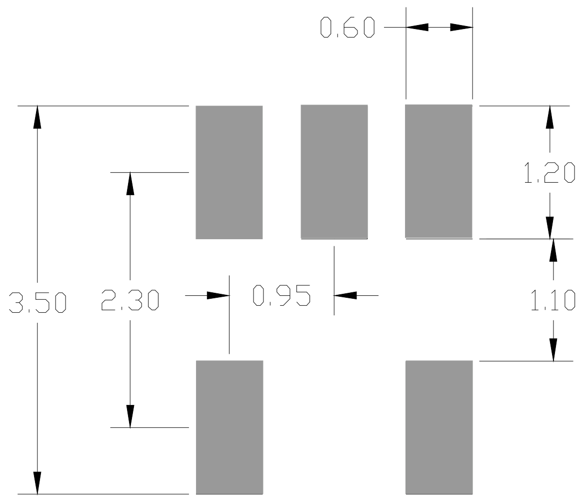


Table 8: SOT23-5L package mechanical data

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
θ	0°		8°

Figure 36: SOT23-5L recommended footprint



Dimensions are in mm

7.2 SOT23-5L packing information

Figure 37: SOT23-5L tape and reel outline

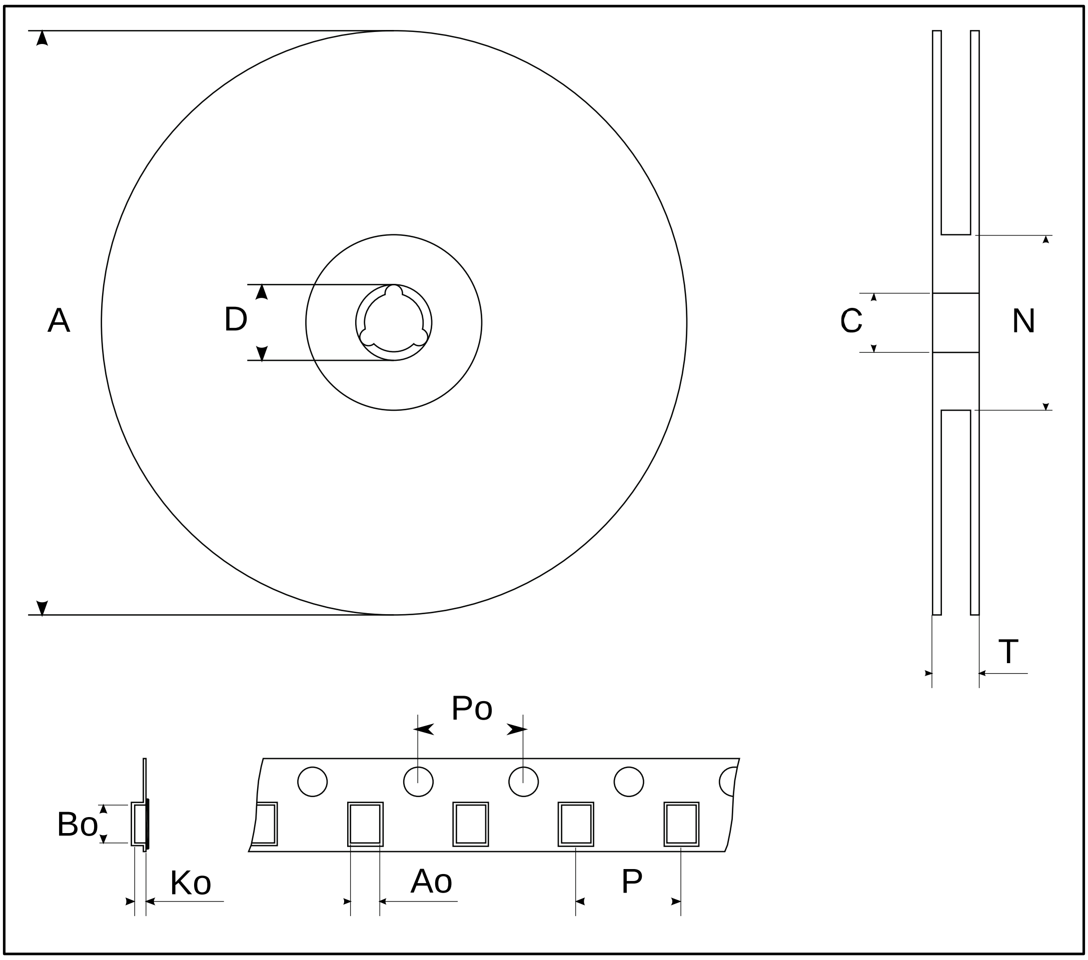


Table 9: SOT23-5L tape and reel mechanical data

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

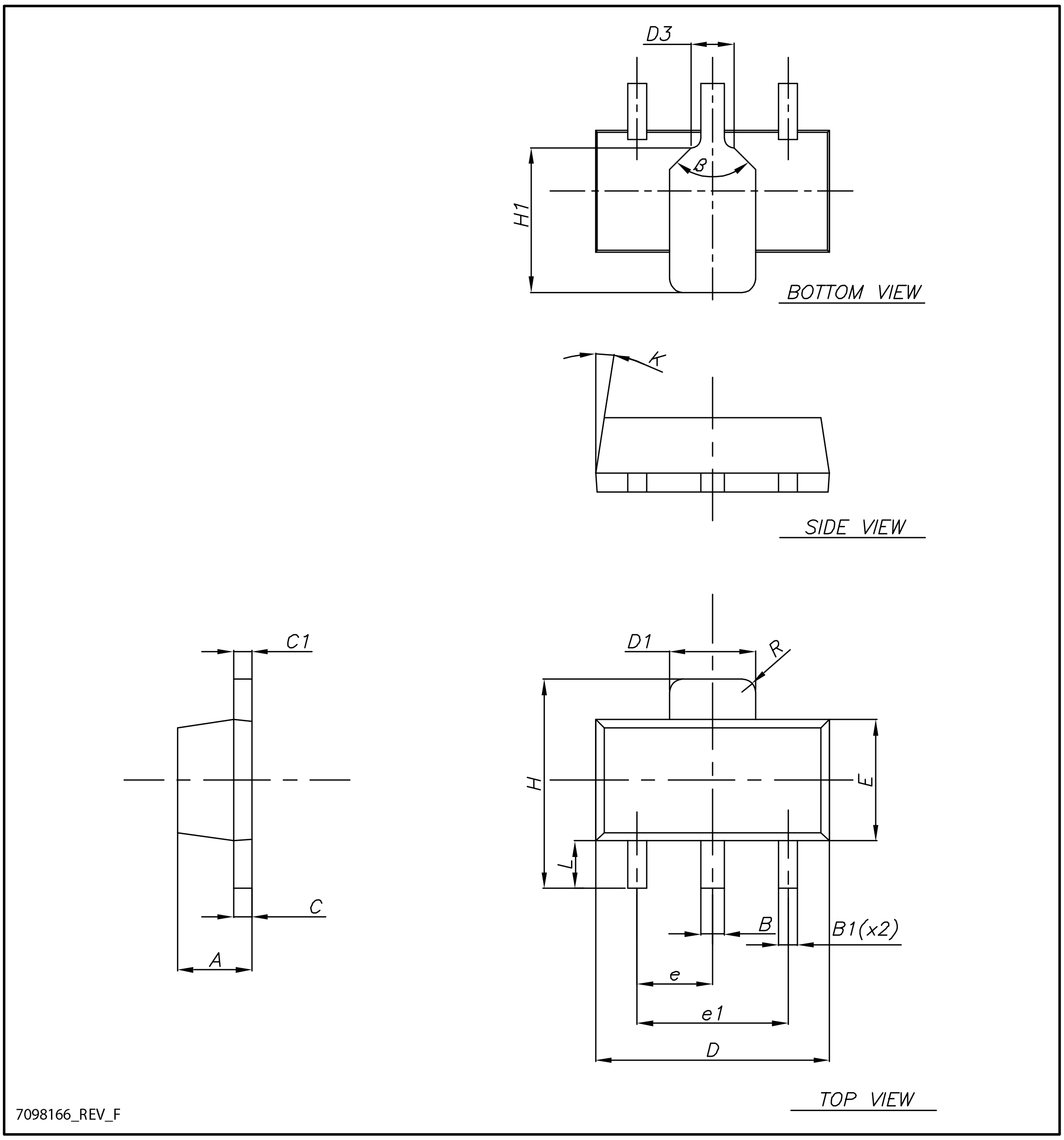
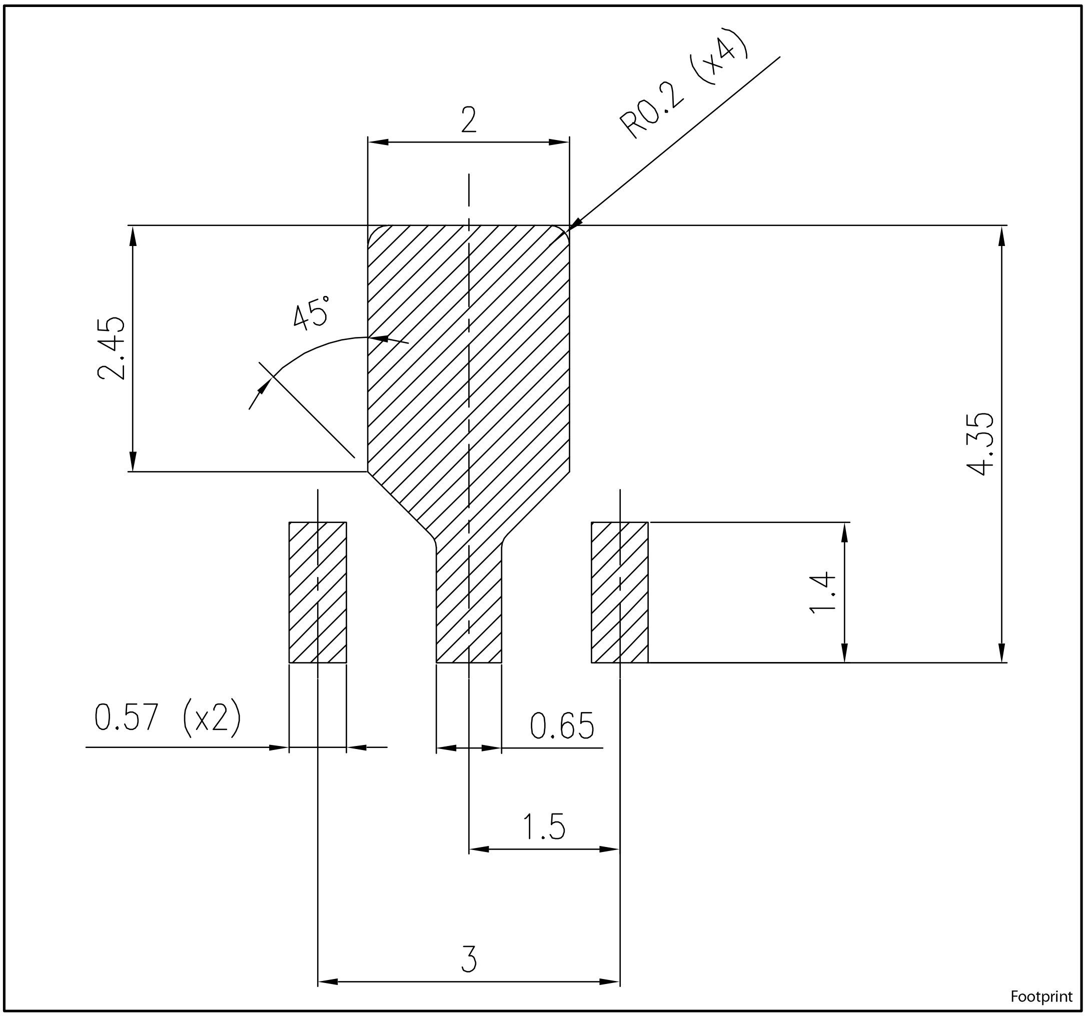


Table 10: SOT-89 mechanical data

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



7.4 SOT-89 packing information

Figure 40: SOT-89 carrier tape outline

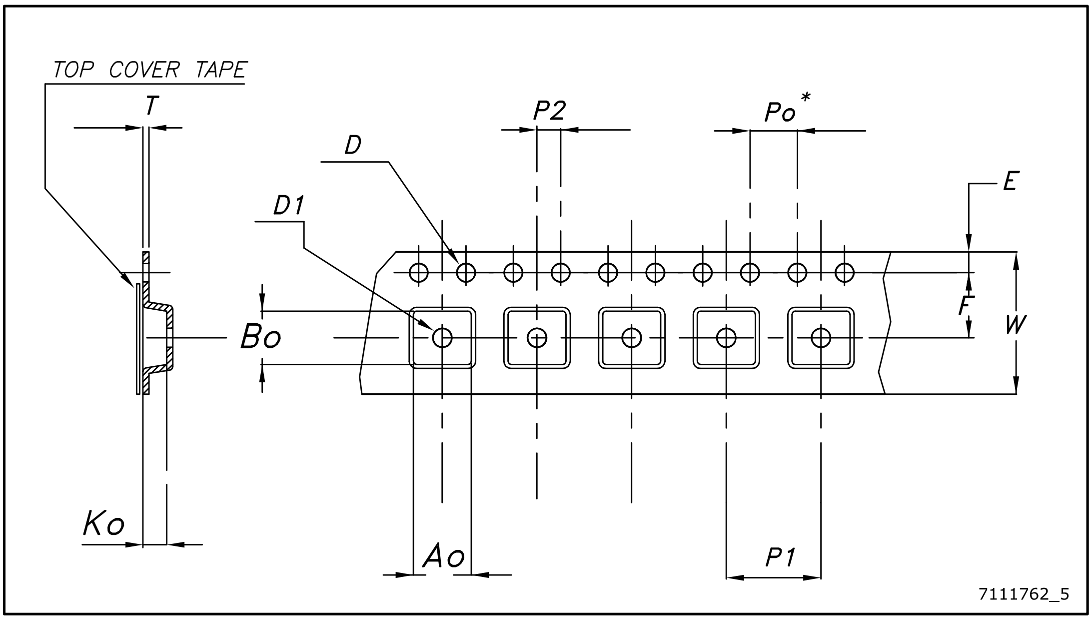


Table 11: SOT-89 tape and reel mechanical data

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	Ø 1.55	± 0.05
D1	Ø 1.60	± 0.10

8 Ordering information

Table 12: Order code

SOT23-5L	SOT-89 (D configuration)	Accuracy (%)	Output voltage (V)
LDK320AM-R		0.5	ADJ
LDK320M-R		2	
LDK320AM30R		0.5	3
LDK320M30R		2	
LDK320AM33R	LDK320ADU33R (1)	0.5	3.3
LDK320M33R		2	
LDK320AM50R		0.5	5
LDK320M50R		2	

Notes:

(1) Available on request.

9 Revision history

Table 13: Document revision history

Date	Revision	Changes
16-Nov-2015	1	First release.