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LDK220

200 mA low quiescent current and low noise LDO

SOT23-5L

SOT-89

SOT323-5L

DFN6-1.2x1.3
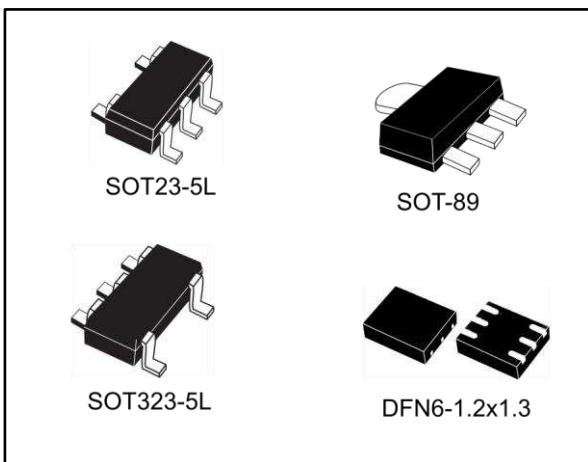
Features

- Input voltage from 2.5 to 13.2 V
- Very low-dropout voltage (100 mV typ. @ 100 mA load)
- Low quiescent current (typ. 55 µA, 1 µA in off mode)
- Low noise
- Output voltage tolerance: ± 2.0% @ 25 °C
- 200 mA guaranteed output current
- 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
- Internal current and thermal limit
- Available in SOT23-5L, SOT323-5L, SOT-89 and DFN6-1.2x1.3 packages
- Temperature range: -40 °C to 125 °C

Applications

- Battery-powered equipment
- TV
- Set-top box
- PC and laptop
- Industrial

Description

The LDK220 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 13.2 V, with a typical dropout voltage of 100 mV.

A ceramic capacitor stabilizes it on the output.

The very low drop voltage, low quiescent current and low noise make it suitable for battery-powered applications.

The enable logic control function puts the LDK220 in shutdown mode allowing a total current consumption lower than 1 µA.

The device also includes a short-circuit constant current limiting and thermal protection.

Contents

1 Diagram

Figure 1: Block diagram (fixed version)
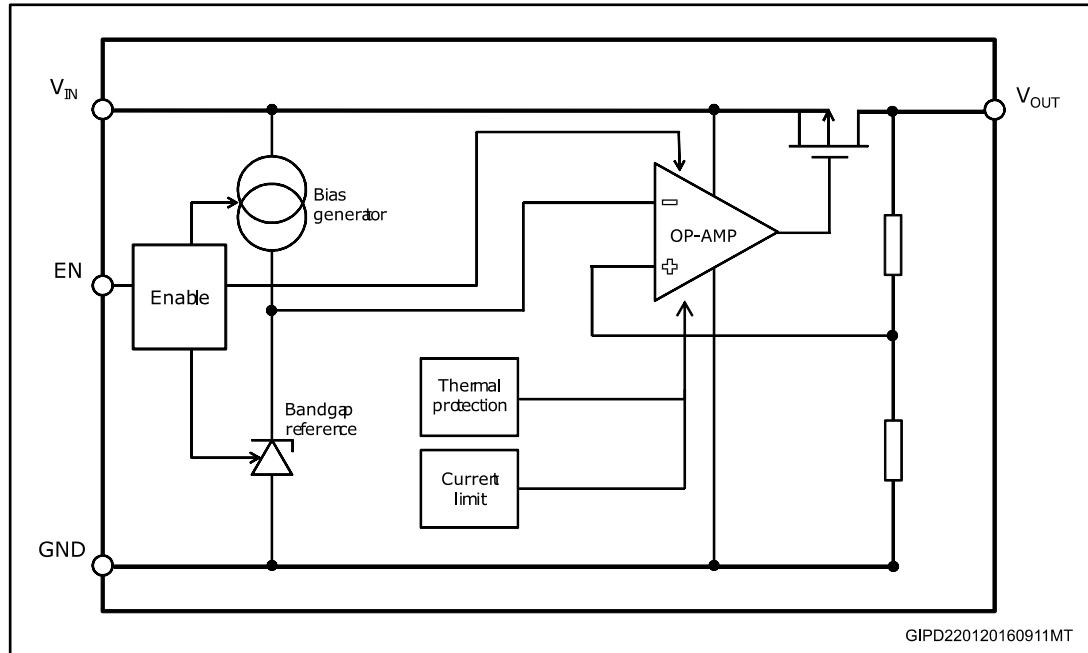
Figure 2: Block diagram (adjustable version)
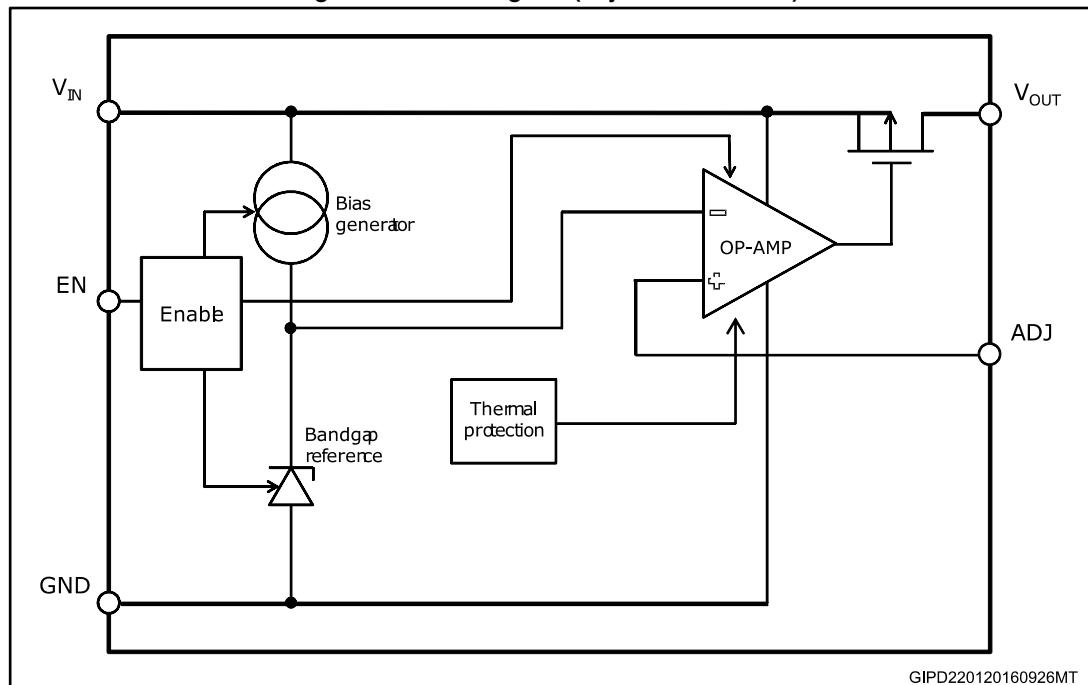
2   Pin configuration

Figure 3: Pin connections (top view)
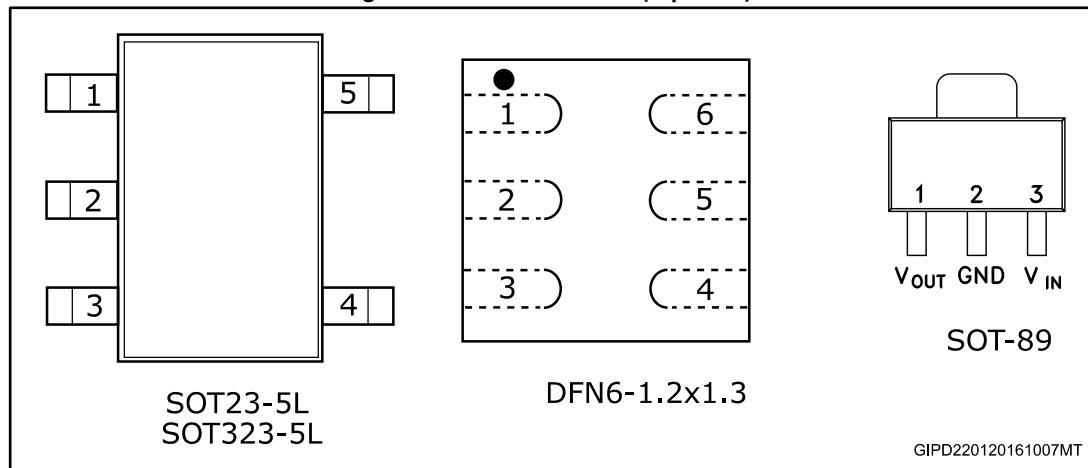
Table 1: Pin description (SOT23-5L, SOT323-5L)

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 (DFN6)

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

Table 3: Pin description (SOT-89)

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

Notes:

[1] Adjustable version and enable pin are not available on the SOT-89 package.

3   Typical application

Figure 4: Typical application circuits

$$V_O = V_{ADJ} (1+R1/R2)$$

Fixed output voltage version   Adjustable output voltage version

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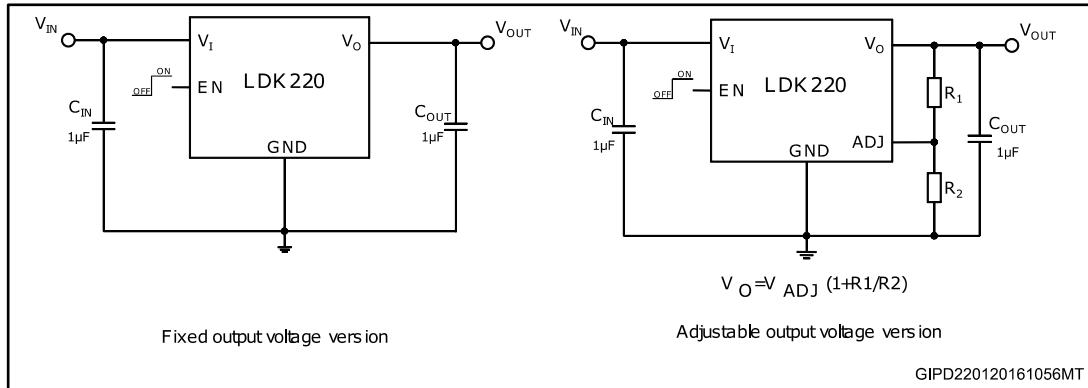
Adjustable version and enable pin are not available on the SOT-89 package.

4 Maximum ratings

Table 4: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{IN}	DC input voltage	- 0.3 to 14	V
V_{OUT}	DC output voltage	- 0.3 to VI + 0.3	V
V_{EN}	Enable input voltage	- 0.3 to VI + 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	500	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 has to be calculated taking into account the package 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	SOT323-5L	SOT-89	DFN-6	Unit
R_{thJA}	Thermal resistance junction-ambient	160	246	110	237	°C/W
R_{thJC}	Thermal resistance junction-case	68	134	15	104	°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: LDK220 electrical characteristics for fixed output version

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage		2.5		13.2	V
V_{OUT}	V_{OUT} accuracy	I_{OUT} = 1 mA, T_J = 25 °C	-2		2	%
		I_{OUT} = 1 mA, -40 °C < T_J < 125 °C	-3		3	%
ΔV_{OUT}	Static line regulation	V_{OUT} + 1 V ≤ V_{IN} ≤ 13.2 V, I_{OUT} = 1 mA		0.001	0.05	%/V
ΔV_{OUT}	Static load regulation	I_{OUT} = 1 mA to 200 mA		0.001	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		20		$\mu V_{RMS}/V$
SVR	Supply voltage rejection	V_{IN} = V_{OUTNOM}+ 0.5 V+/-V_{RIPPLE} V_{RIPPLE} = 0.1 V frequency = 120 Hz to 1 kHz I_{OUT} = 10 mA		55		dB
		V_{IN} = V_{OUTNOM} + 0.5 V+/-V_{RIPPLE} V_{RIPPLE} = 0.1 V frequency = 10 kHz I_{OUT} = 10 mA		50		
I_Q	Quiescent current	V_{IN} = V_{OUT} +1 V I_{OUT} = 0 mA,-40 °C < T_J < 125 °C		55	90	µA
		V_{OUT} +1 V ≤ V_{IN} ≤ 13.2 V [2] 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		0.1	1	
I_{SC}	Short-circuit current [2]	R_L = 0		400		mA
V_{EN}	Enable input logic low	V_{IN} = 2.5 V to 13.2 V, -40 °C < T_J < 125 °C			0.4	V
	Enable input logic high	V_{IN} = 2.5 V to 13.2 V, -40 °C < T_J < 125 °C	1.2			
I_{EN}	Enable pin input current	V_{EN} = V_{IN}		0.1	100	nA

| Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
T_{SHDN}	Thermal shutdown			160		°C
	Hysteresis			20		
C_{OUT}	Output capacitor	Capacitance (see *Section 6: "Typical performance 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.

[2] The maximum current has to be limited according to the maximum power dissipation.

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 7: LDK220 electrical characteristics for adjustable version

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage		2.5		13.2	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	
ΔV_{OUT}	Static line regulation	V_{OUT} +1 V ≤ V_{IN} ≤ 13.2 V I_{OUT}=1 mA		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		100		µV_{RMS}/V
I_{ADJ}	Adjust pin current				1	µA
SVR	Supply voltage rejection	V_{IN} = V_{OUTNOM} + 0.5 V+/-V_{RIPPLE} V_{RIPPLE} = 0.1 V Frequency =120 Hz to1 kHz I_{OUT} = 10 mA		60		dB
		V_{RIPPLE} = 0.1 V V_{IN} = V_{OUTNOM}+0.5 V+/-V_{RIPPLE} frequency = 10 kHz, I_{OUT} = 10 mA		45		

| Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_Q	Quiescent current	V_{OUT} +1 V ≤ V_{IN} ≤ 13.2 V I_{OUT} = 0 mA, -40 °C < T_J < 125 °C		55	90	µA
		V_{OUT} +1 V ≤ V_{IN} ≤ 13.2 V [2] 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		0.1	1	
I_{SC}	Short-circuit current [2]	R_L = 0		400		mA
V_{EN}	Enable input logic low	V_{IN} = 2.5 V to 13.2 V -40 °C < T_J < 125 °C			0.4	V
	Enable input logic high	V_{IN} = 2.5 V to 13.2 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 performance 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.

[2] The maximum current has to be limited according to the maximum power dissipation.

6 Typical performance characteristics

(C_{IN} = C_{OUT} = 1 µF, V_{EN} to V_{IN})

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

V_{IN} = 2.5 V, I_{OUT} = 1 mA

GIPD250120161000MT
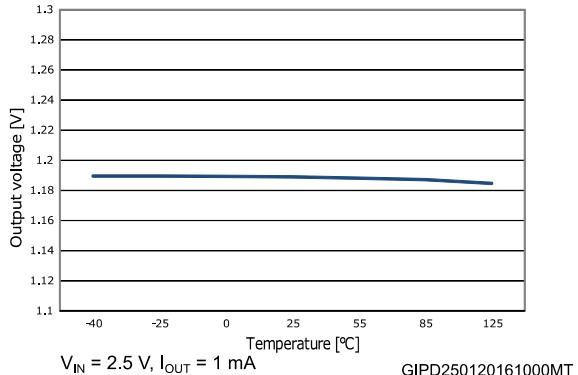
Figure 6: Output voltage vs. temperature (V_{OUT} = V_{ADJ}, I_{OUT} = 200 mA)

V_{IN} = 2.5 V, I_{OUT} = 200 mA

GIPD250120161001MT
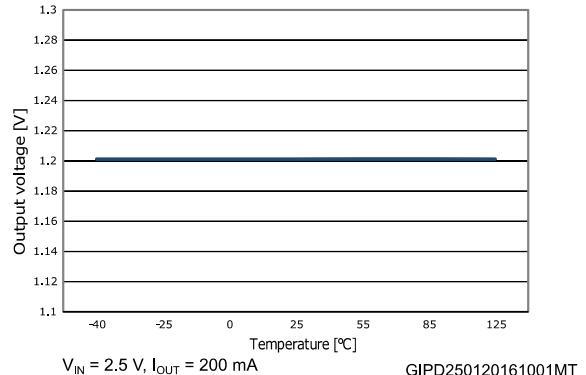
Figure 7: Output voltage vs. temperature (V_{OUT} = 3.3 V, I_{OUT} = 1 mA)

V_{IN} = 4.3 V, I_{OUT} = 1 mA

GIPD250120161001MT
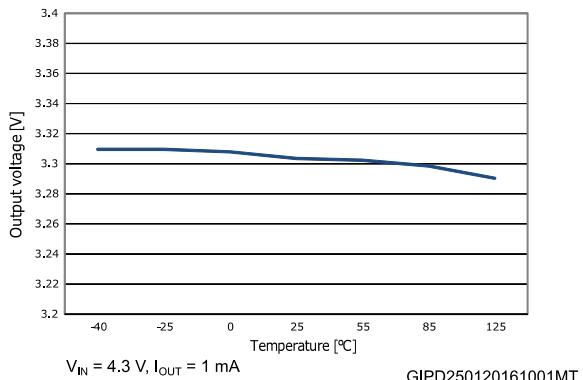
Figure 8: Output voltage vs. temperature (V_{OUT} = 3.3 V, I_{OUT} = 200 mA)

V_{IN} = 4.3 V, I_{OUT} = 200 mA

GIPD250120161003MT
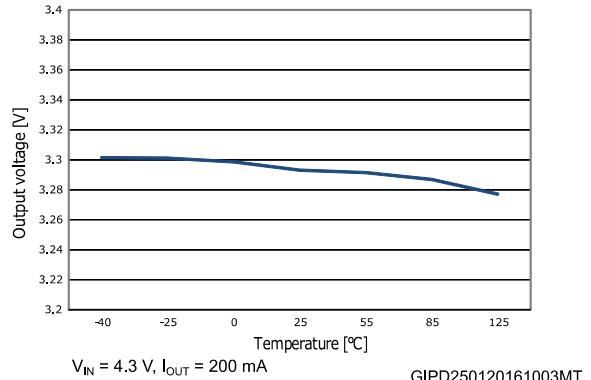
Figure 9: Short-circuit current vs. temperature

V_{IN} = 4 V

GIPD250120161004MT
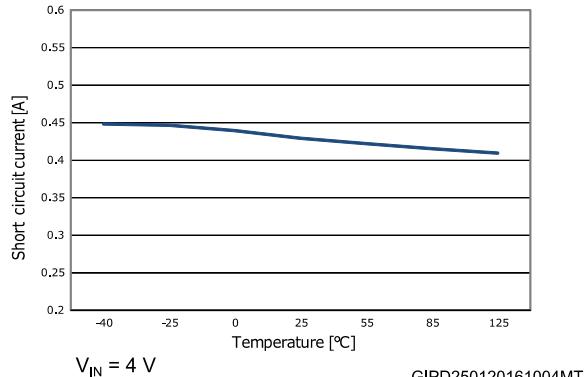
Figure 10: Line regulation vs. temperature (V_{OUT} = 3.3 V)

V_{OUT} = 3.3 V, I_{OUT} = 1 mA

GIPD250120161005MT
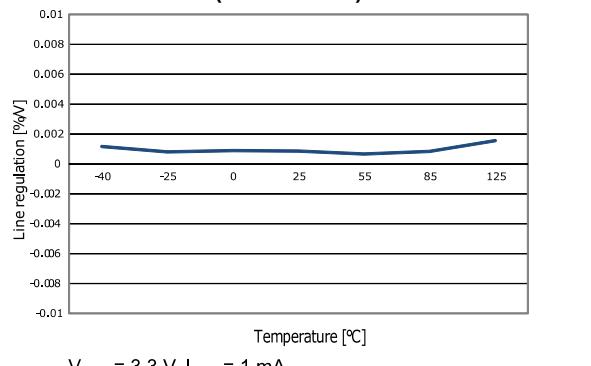
Figure 11: Line regulation vs. temperature
(V_{OUT} = V_{ADJ})

V_{OUT} = V_{ADJ}, I_{OUT} = 1 mA

GIPD250120161006MT
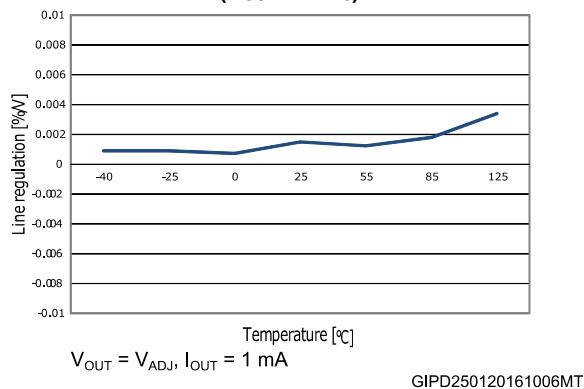
Figure 12: Load regulation vs. temperature
(V_{OUT} = 3.3 V)

V_{OUT} = 3.3 V, I_{OUT} = 1 mA to 200 mA

GIPD250120161007MT
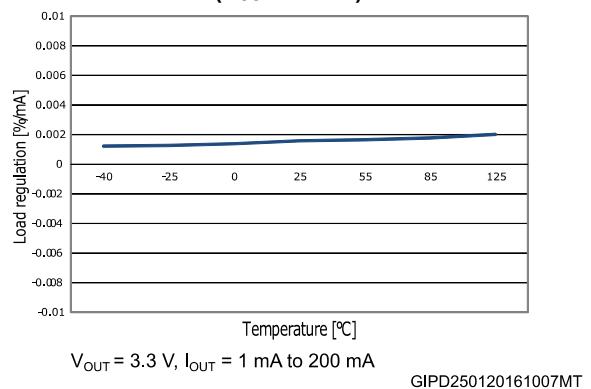
Figure 13: Load regulation vs. temperature
(V_{OUT} = V_{ADJ})

I_{OUT} = 1 mA to 200 mA

GIPD250120161008MT
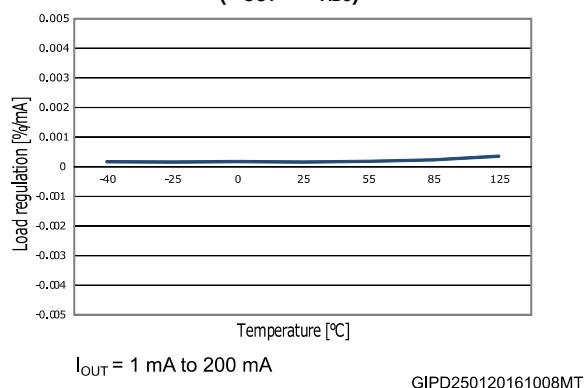
Figure 14: Enable thresholds vs. temperature

I_{OUT} = 1 mA

GIPD250120161009MT
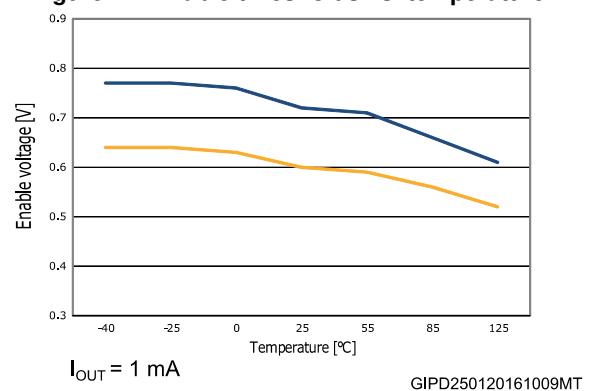
Figure 15: Dropout voltage vs. temperature

V_{OUT} = 3.3 V

GIPD250120161010MT
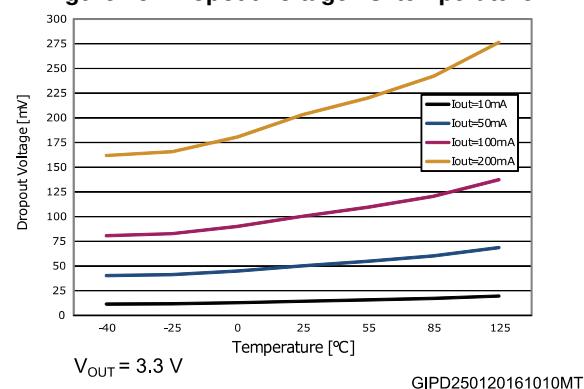
Figure 16: Quiescent current vs. temperature
(I_{OUT} = 0 mA)

GIPD250120161011MT
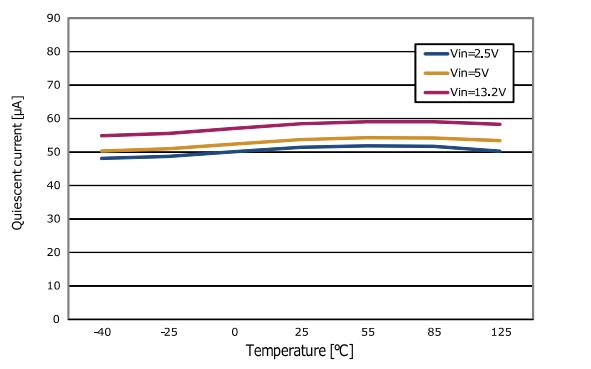
Figure 17: Quiescent current vs. temperature (I_{OUT} = 200 mA)

GIPD250120161012MT
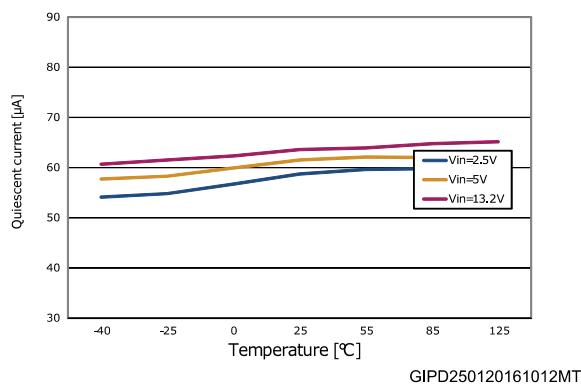
Figure 18: Off-state current vs. temperature

GIPD250120161013MT
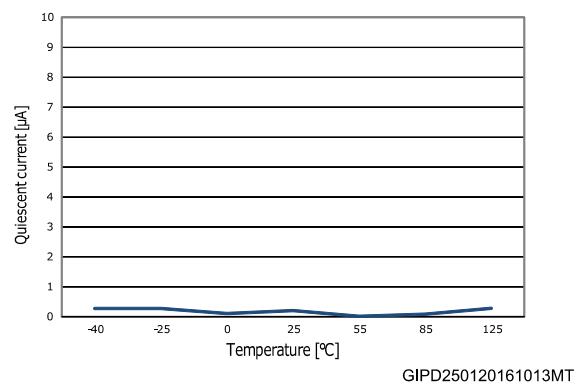
Figure 19: SVR vs. frequency (V_{OUT} = 3.3 V)

V_{IN} = 3.7 V +/-100 mV, V_{OUT} = 3.3 V, C_{OUT} = 1 µF

GIPD250120161014MT
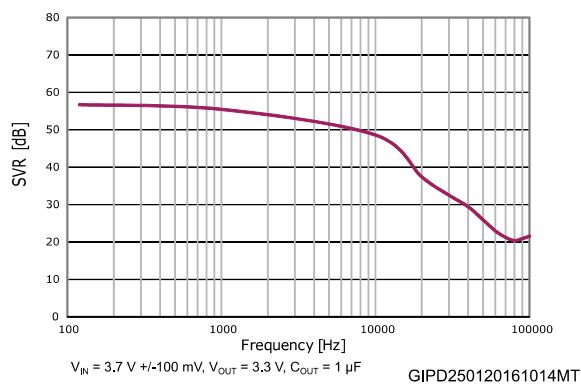
Figure 20: SVR vs. frequency (V_{OUT} = V_{ADJ})

V_{IN} = 2.5 V +/- 100 mV, V_{OUT} = V_{ADJ}, C_{OUT} = 1 µF

GIPD250120161015MT
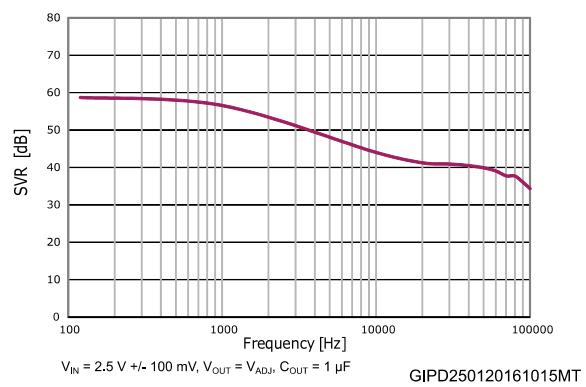
Figure 21: Output noise spectral density

V_{OUT} = 3.3 V, C_{IN} = C_{OUT} = 1 µF

GIPD250120161016MT
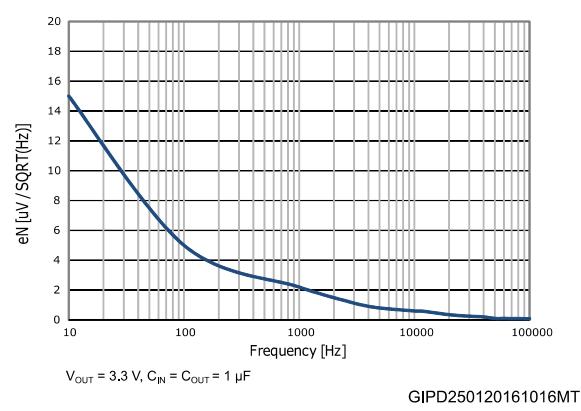
Figure 22: Stability vs. (C_{OUT}, ESR)

STABILITY AREA

V_{IN} from 2.5 to 13.2 V, I_{OUT} from 0 to 200 mA, C_{IN} = 1 µF

GIPD250120161017MT
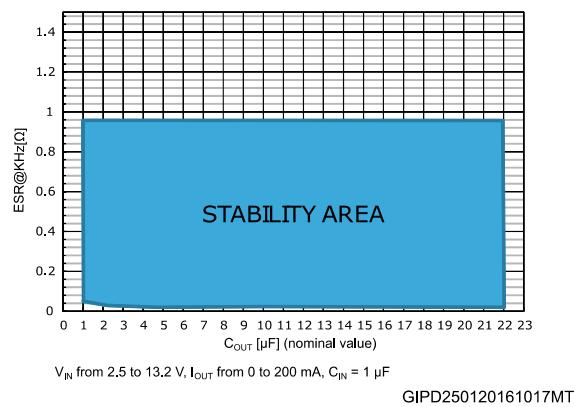
Figure 23: Startup with enable (V$_{OUT}$ = 3.3 V)

V$_{IN}$ = 4.3 V, V$_{EN}$ = 0 V to 2 V, I$_{OUT}$ = 0.2 A, V$_{OUT}$ = 3.3 V, T$_r$ = T$_f$ = 1 μs

GIPD250120161426MT
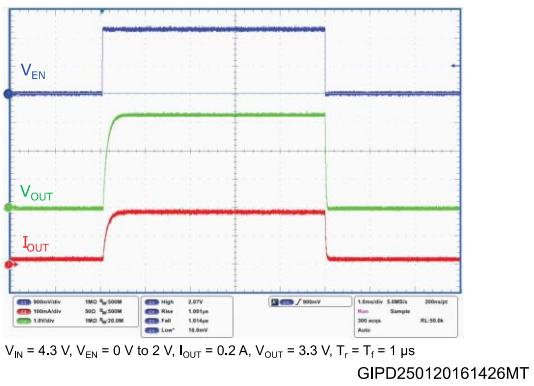
Figure 24: Startup with enable (V$_{OUT}$ = V$_{ADJ}$)

V$_{IN}$ = 2.5 V, V$_{EN}$ = 0 V to V$_{IN}$, I$_{OUT}$ = 0.2 A, V$_{OUT}$ = V$_{ADJ}$, T$_r$ = T$_f$ = 1 μs

GIPD250120161427MT
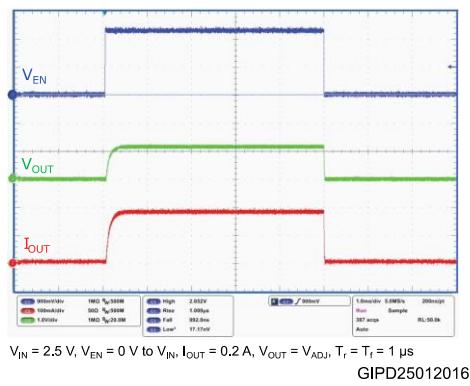
Figure 25: Turn-on time (V$_{OUT}$ = 3.3 V)

V$_{IN}$ = V$_{EN}$ = 0 V to 4.3 V, I$_{OUT}$ = 0.2 A, V$_{OUT}$ = 3.3 V, T$_r$ = 5 μs

GIPD250120161428MT
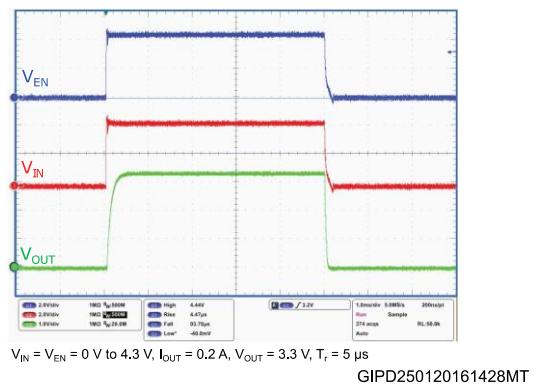
Figure 26: Turn-on time (V$_{OUT}$ = V$_{ADJ}$)

V$_{IN}$ = V$_{EN}$ = 0 V to 2.5 V, I$_{OUT}$ = 0.2 A, V$_{OUT}$ = V$_{ADJ}$, Tr = 5 μs

GIPD250120161429MT
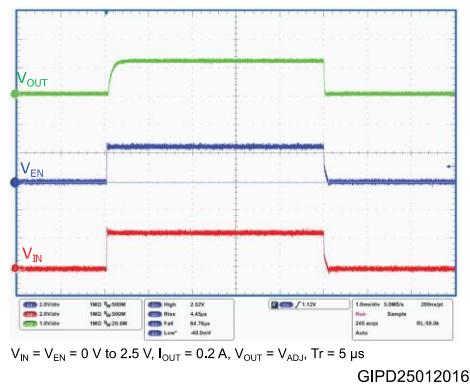
Figure 27: Line transient (V$_{OUT}$ = 3.3 V)

V$_{IN}$ = V$_{EN}$ = 4.3 V to 5.3 V, I$_{OUT}$ = 1 mA, V$_{OUT}$ = 3.3 V, T$_r$ = T$_f$ = 5 μs

GIPD250120161430MT
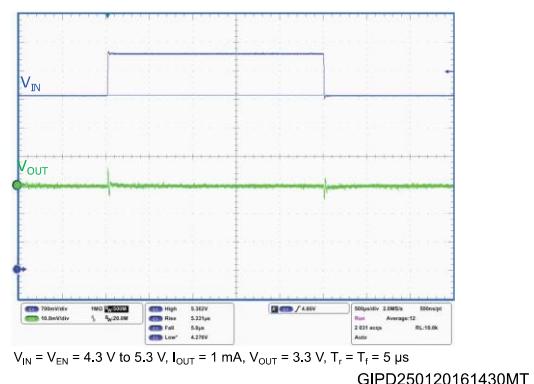
Figure 28: Line transient (V$_{OUT}$ = V$_{ADJ}$)

V$_{IN}$ = V$_{EN}$ = 2.5 V to 3.5 V, I$_{OUT}$ = 1 mA, V$_{OUT}$ = V$_{ADJ}$, T$_r$ = T$_f$ = 5 μs

GIPD250120161431MT
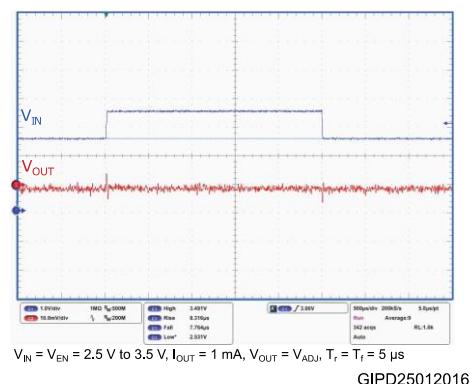
Figure 29: Load transient (V_{OUT} = 3.3 V)
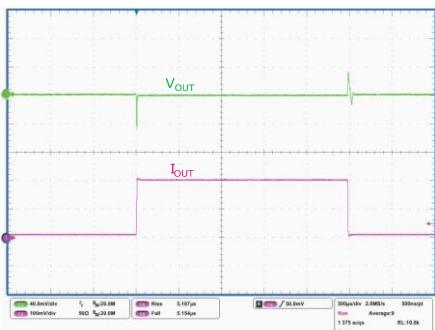
$V_{IN} = V_{EN} = 4.3$ V, $I_{OUT} = 1$ mA to 0.2 A, $V_{OUT} = 3.3$ V, $T_r = T_f = 5$ µs

GIPD250120161432MT

Figure 30: Load transient (V_{OUT} = V_{ADJ})
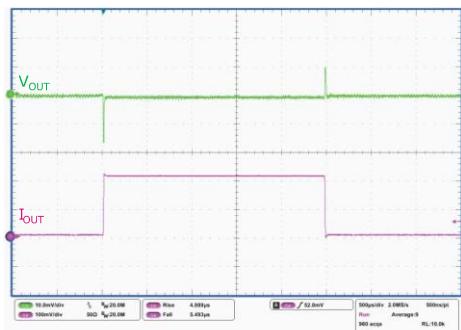
$V_{IN} = V_{EN} = 2.5$ V, $I_{OUT} = 1$ mA to 0.2 A, $V_{OUT} = V_{ADJ}$, $T_r = T_f = 5$ µs

GIPD250120161433MT

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 information

Figure 31: SOT23-5L package outline

7049676_k
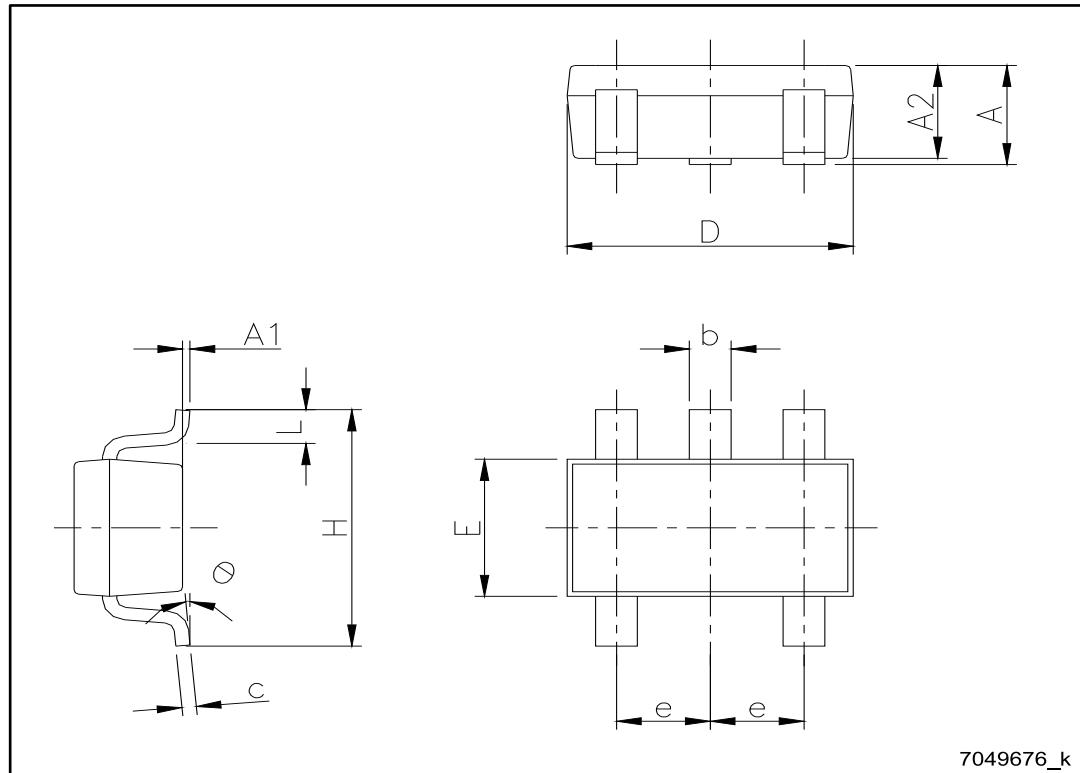
Table 8: SOT23-5L package mechanical data

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
θ	0°		8°

Figure 32: SOT23-5L recommended footprint
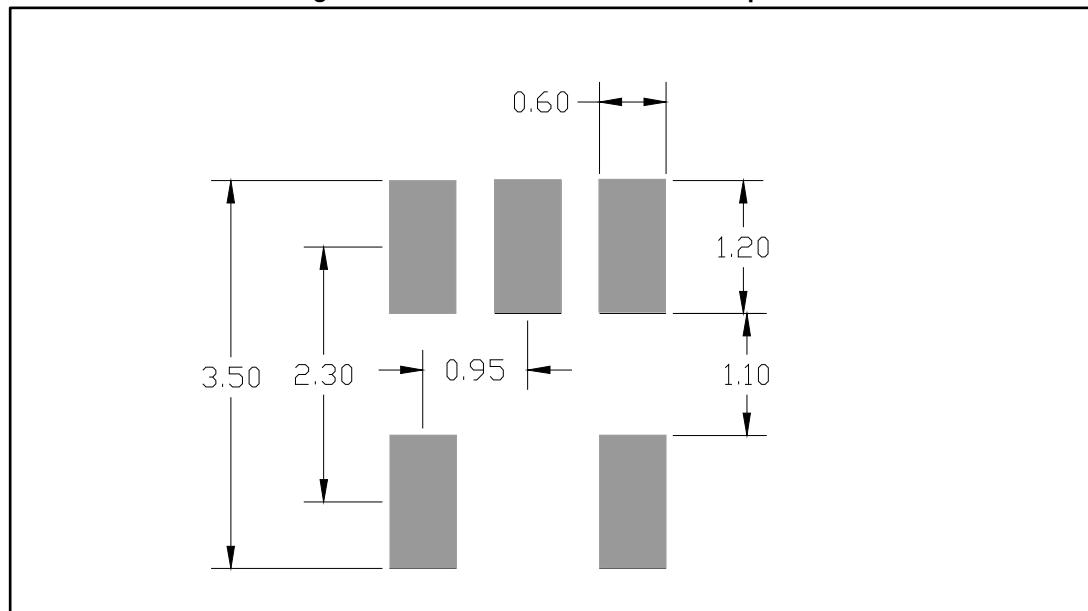
Dimensions are in mm

7.2   SOT23-5L packing information

**Figure 33: SOT23-5L tape and reel outline**
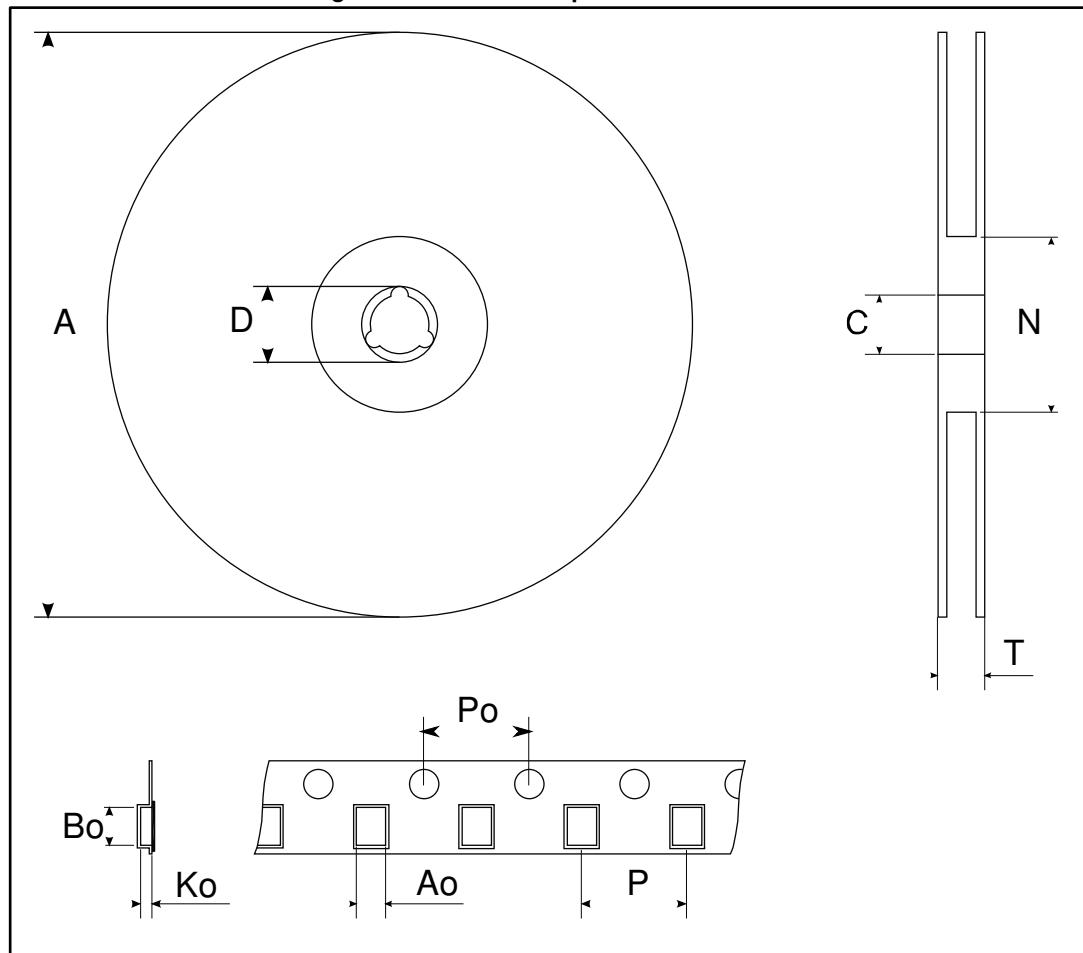
Table 9: SOT23-5L tape and reel mechanical data

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 34: SOT-89 package outline

7098166_REV_F
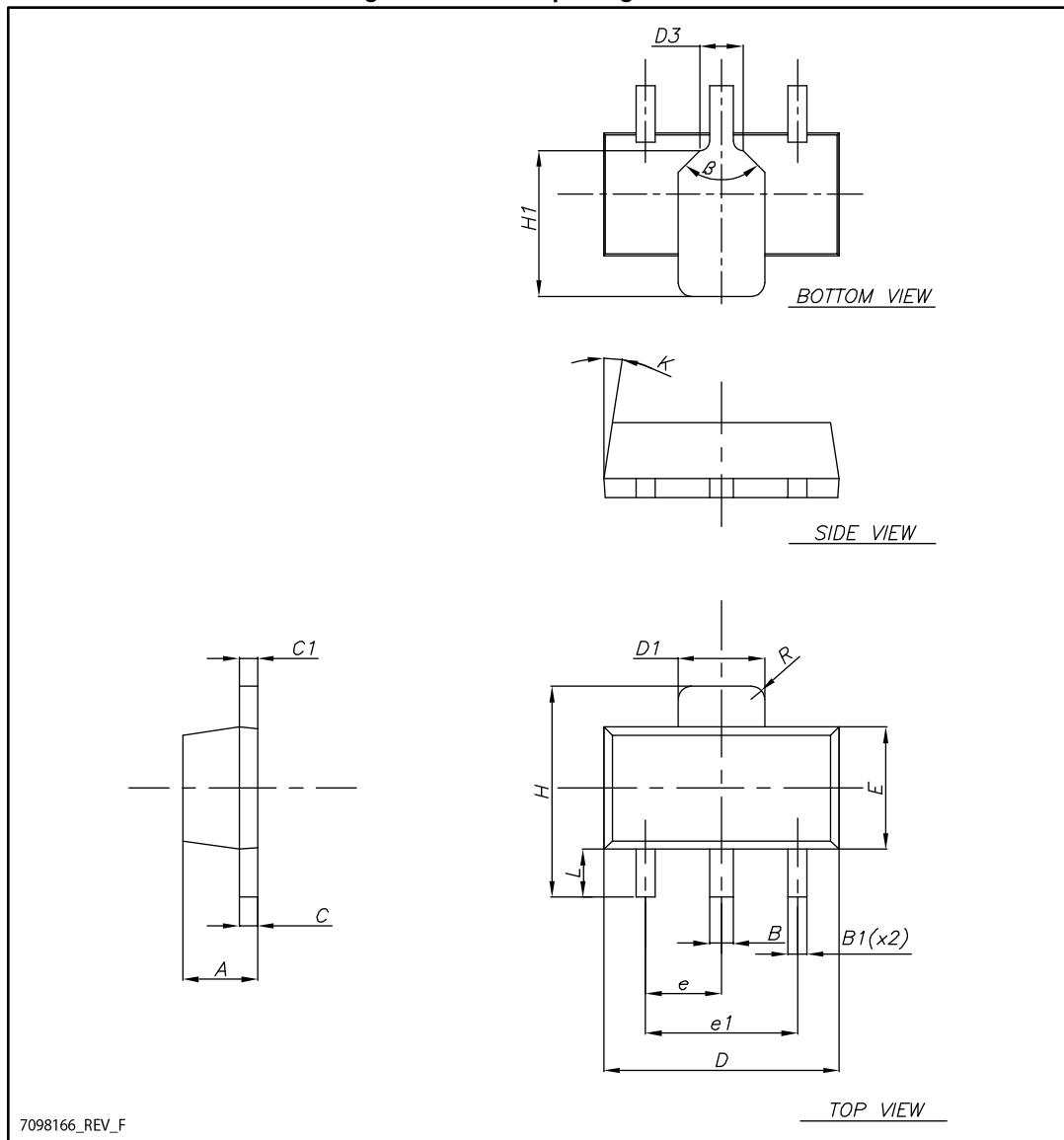
Table 10: SOT-89 mechanical data

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 35: SOT-89 recommended footprint

Footprint
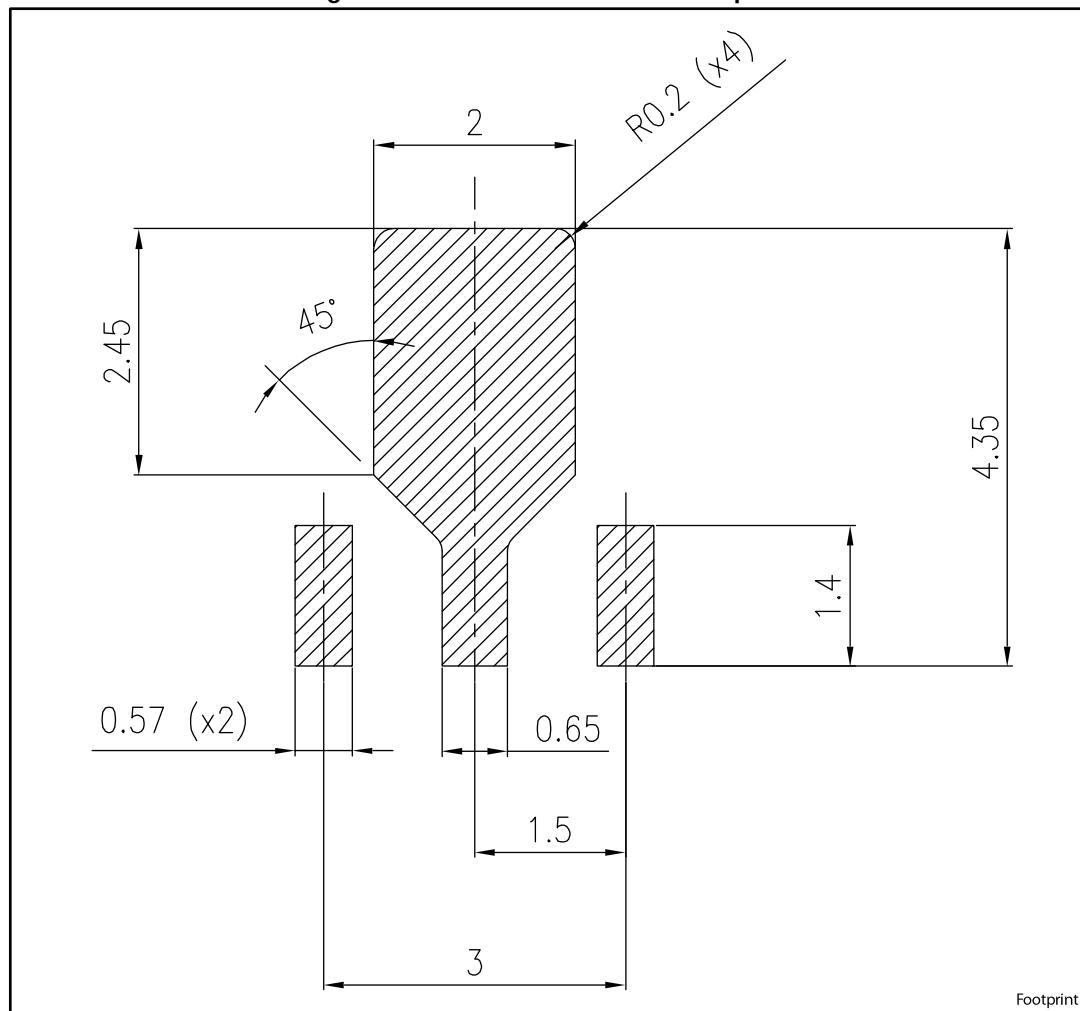
7.4   SOT-89 packing information

Figure 36: SOT-89 carrier tape outline
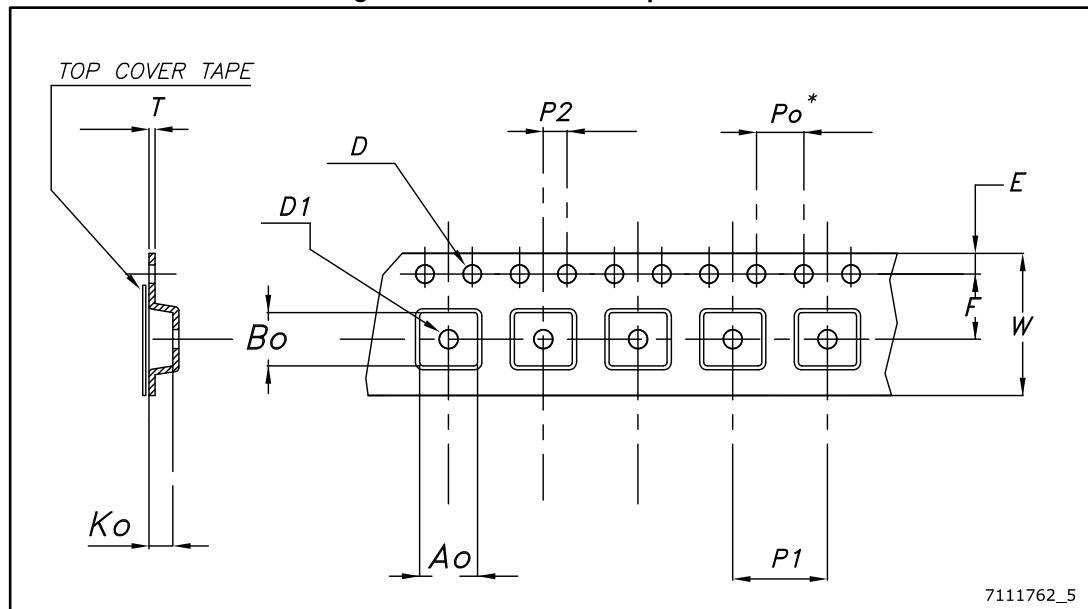
Table 11: SOT-89 carrier tape mechanical data

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	Ø 1.55	± 0.05
D1	Ø 1.60	± 0.10

7.5   SOT323-5L package information

Figure 37: SOT323-5L package outline
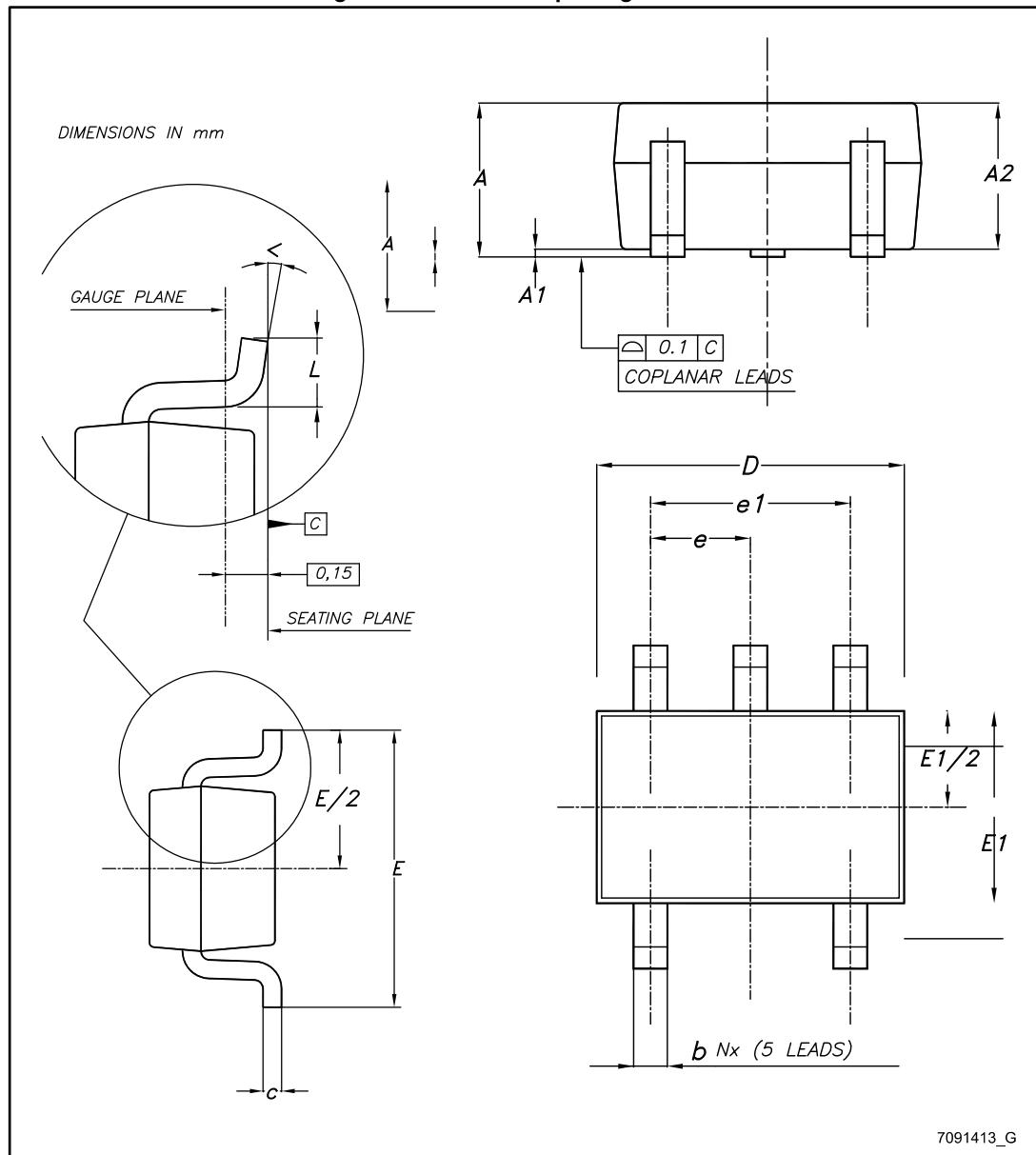
Table 12: SOT323-5L package mechanical data

Dim.	mm		
	Min.	**Typ.**	**Max.**
A	0.80		1.10
A1	0		0.10
A2	0.80	0.90	1
b	0.15		0.30
c	0.10		0.22
D	1.80	2	2.20
E	1.80	2.10	2.40
E1	1.15	1.25	1.35
e		0.65	
e1		1.30	
L	0.26	1.36	0.46
<	0°		8°

Figure 38: SOT323-5L recommended footprint
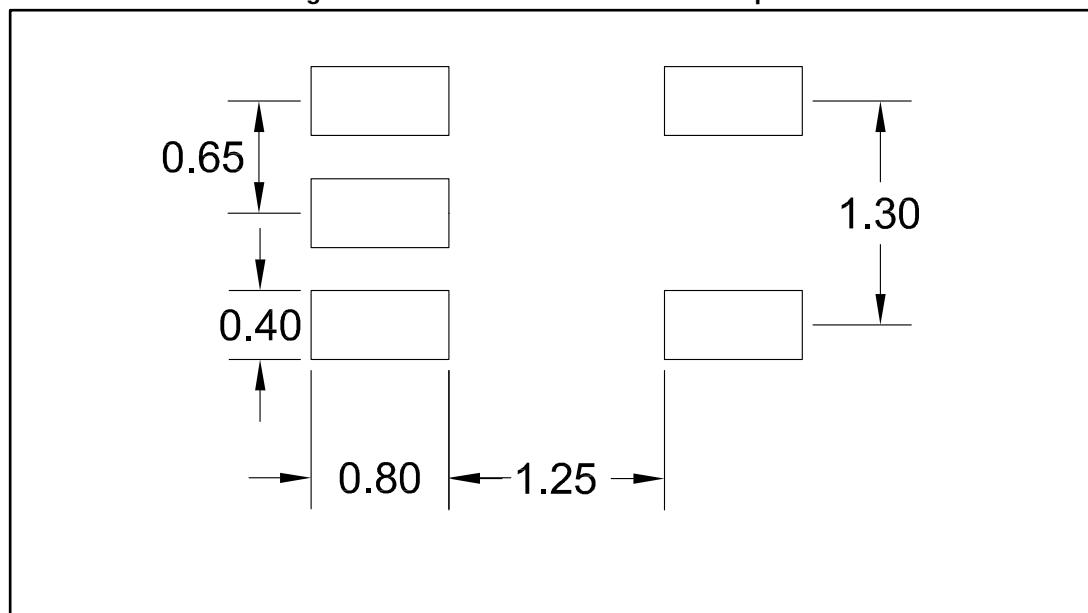
7.6 DFN6 1.2x1.3 package information

Figure 39: DFN6 package outline

8442779_A
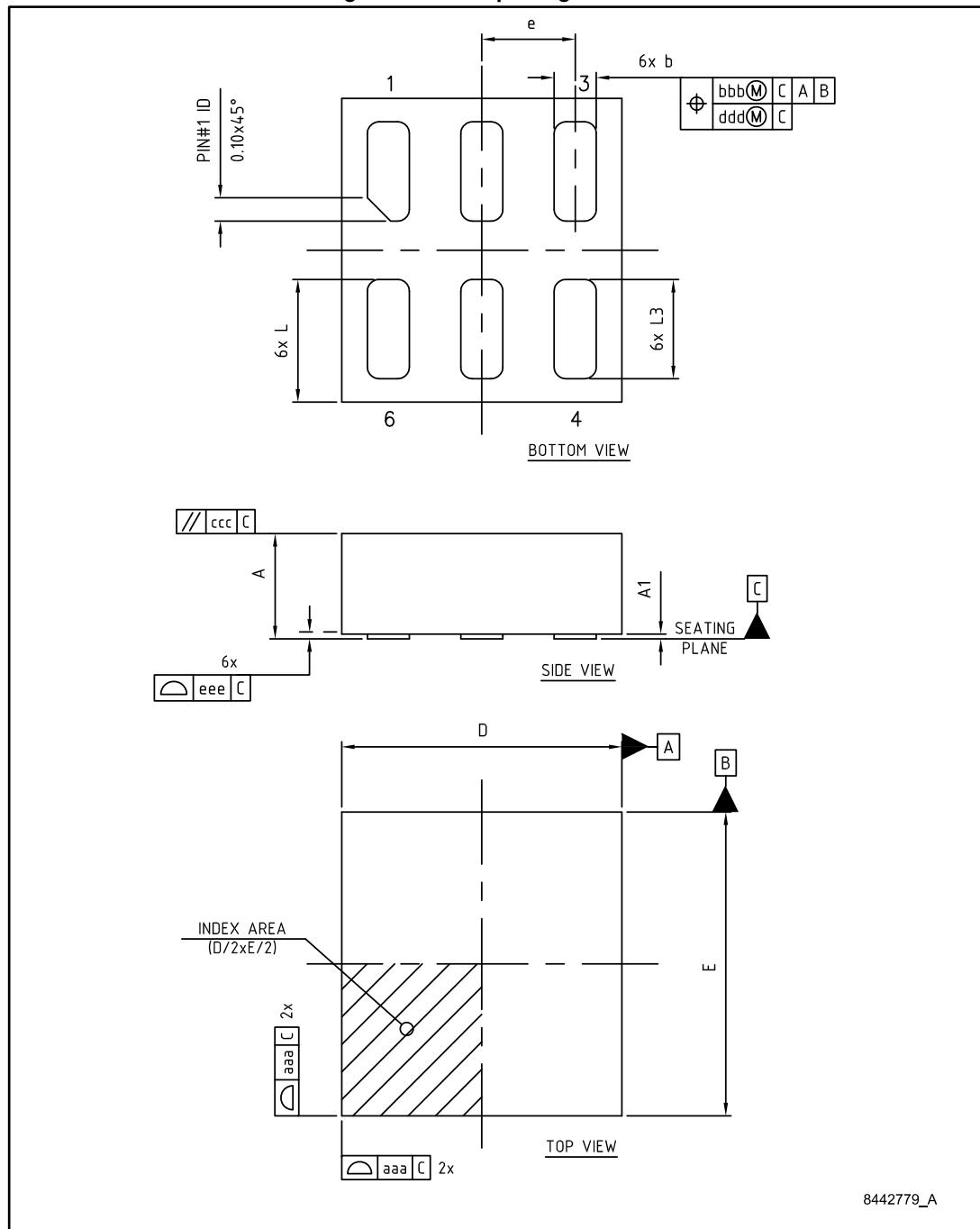
Table 13: DFN6 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.41	0.45	0.50
A1	0.00	0.02	0.05
D	-	1.20	-
E	-	1.30	-
e	-	0.40	-
b	0.15	0.18	0.25
L	0.475	0.525	0.575
L3	0.375	0.425	0.475
aaa	-	0.05	-
bbb	-	0.10	-
ccc	-	0.05	-
ddd	-	0.05	-
eee	-	0.05	-

Figure 40: DFN6 recommended footprint