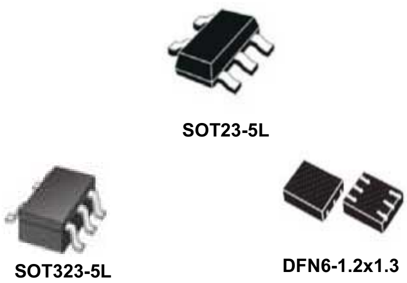
200 mA low quiescent current and low noise LDO

Datasheet - production data



Features

- Input voltage from 2.5 to 13.2 V
- Very low-dropout voltage (100 mV typ. @ 100 mA load)
- Low quiescent current (typ. 40 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 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.

This is information on a product in full production.

Contents

1 Diagram

Figure 1. Block diagram (fixed version)

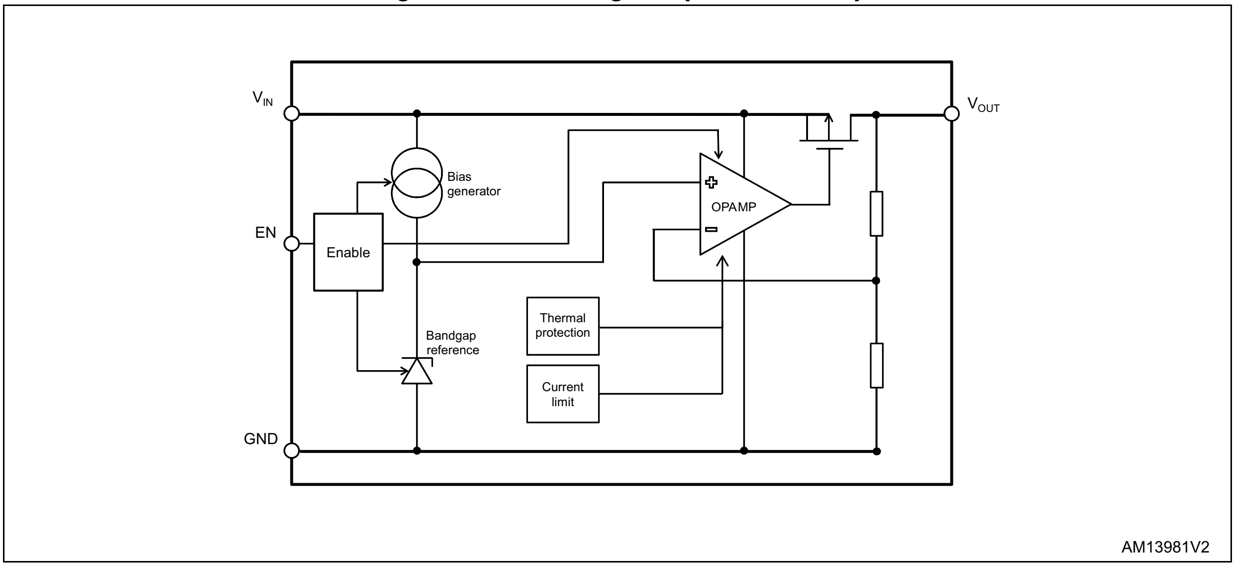
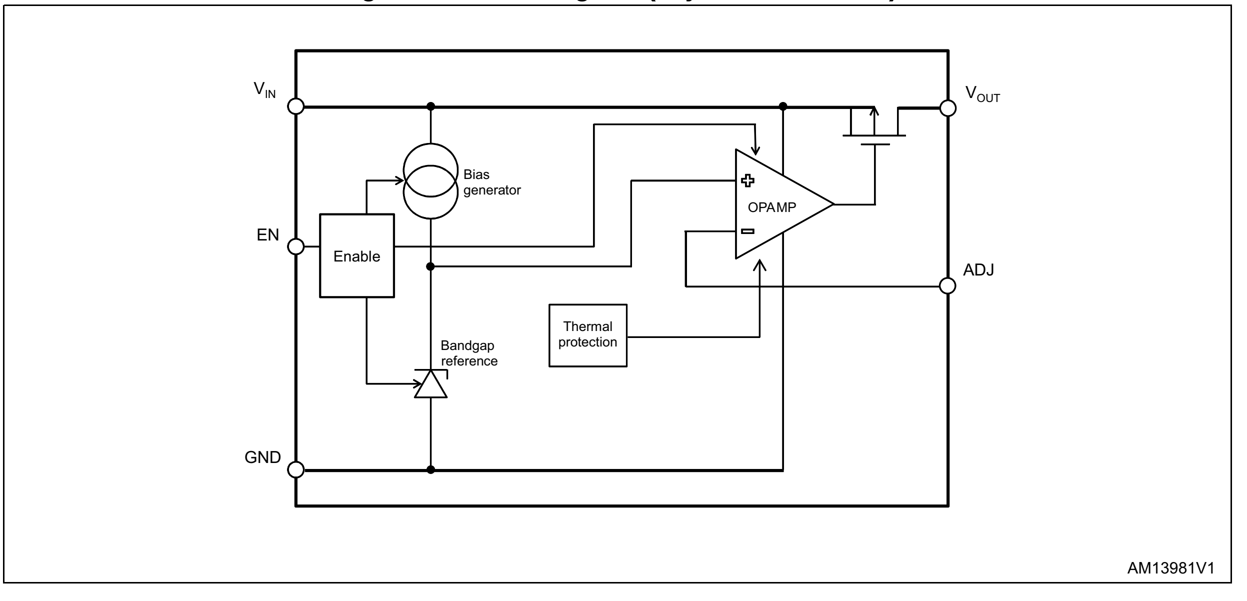


Figure 2. Block diagram (adjustable version)



2 Pin configuration

Figure 3. Pin connection (top view)

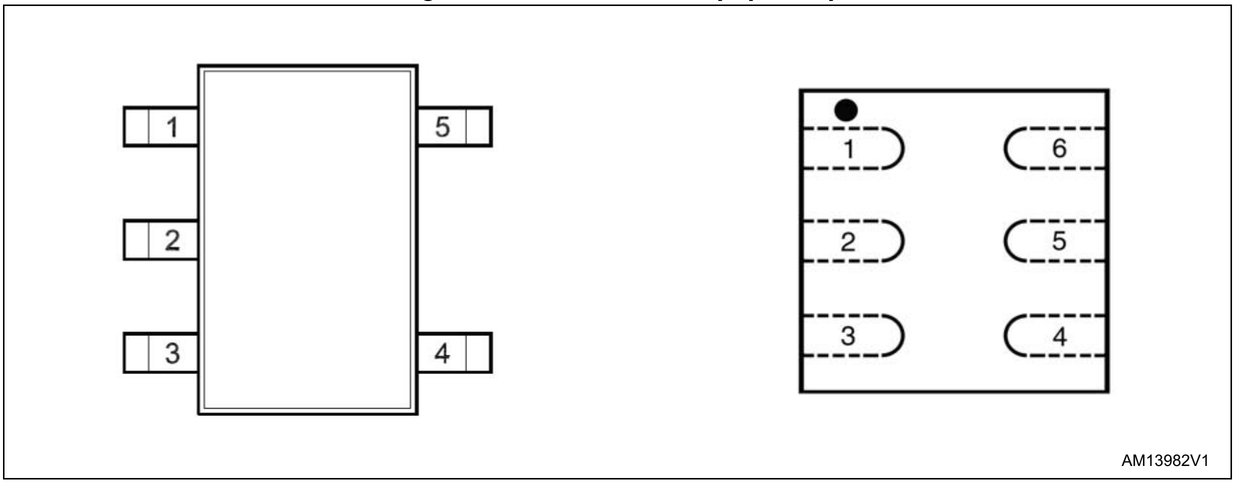


Table 1. Pin description (SOT23-5L, SOT323-5L)

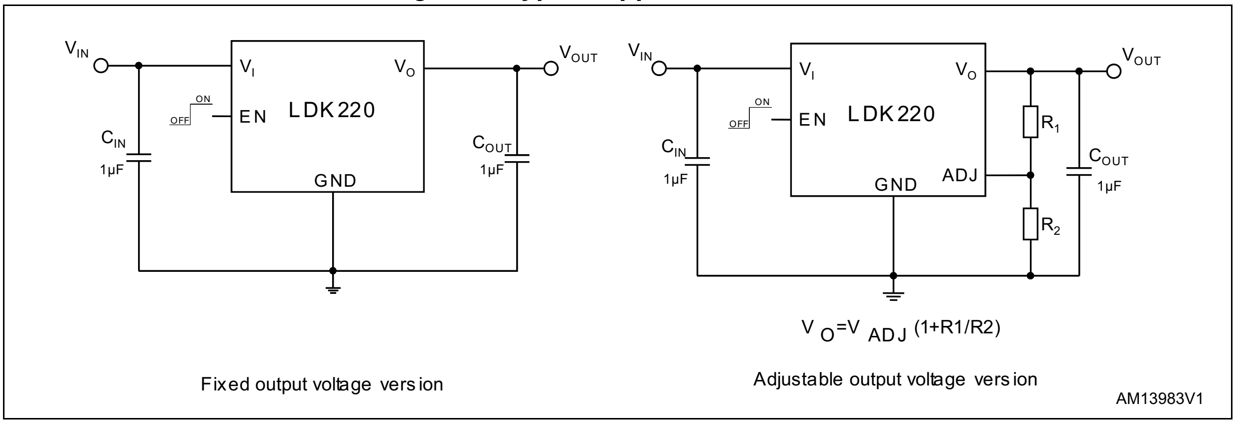
Pin	Symbol	Function
1	IN	Input voltage of the LDO
2	GND	Common ground
3	EN	Enable pin logic input: low = shutdown, high = active
4	ADJ/NC	Adjustable pin on ADJ version, not connected on fixed version
5	OUT	Output voltage of the LDO

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

3 Typical application

Figure 4. Typical application circuits



4 Maximum ratings

Table 3. 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 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	500	mW
T_{STG}	Storage temperature range	- 65 to 150	°C
T_{OP}	Operating junction temperature range	- 40 to 125	°C

1. Maximum power dissipation has to be calculated taking into account the package 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 4. Thermal data

Symbol	Parameter	SOT23-5L	SOT323-5L	DFN-6	Unit
R_{thJA}	Thermal resistance junction-ambient	160	246	237	°C/W
R_{thJC}	Thermal resistance junction-case	68	134	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 5. 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	-2.0		2.0	%
		I_{OUT} = 1 mA, -40 °C<T_J<125 °C	-3.0		3.0	%
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		μV_{RMS}/V
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		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		40	60	µA
		V_{OUT} +1 V ≤ V_{IN} ≤ 13.2 V(2) I_{OUT}=200 mA,-40 °C<T_J<125 °C		55	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 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.
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 6. 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}	V_{ADJ} accuracy	I_{OUT} = 1 mA, T_J = 25 °C	-2%	1.19	+2%	mV
		I_{OUT} = 1 mA, -40 °C<T_J<125 °C	-3.0	1.185	3.0	%
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_{IN} = V_{OUTNOM}+0.5 V+/-V_{RIPPLE} V_{RIPPLE} = 0.1 V frequency=10 kHz I_{OUT} = 10 mA		45		
I_Q	Quiescent current	V_{OUT} +1 V ≤ V_{IN} ≤ 13.2 V I_{OUT} = 0 mA,-40 °C<T_J<125 °C		40	60	µA
		V_{OUT} +1 V ≤ V_{IN} ≤ 13.2 V(2) I_{OUT} = 200 mA,-40 °C<T_J<125 °C		55	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 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.
2. The maximum current has to be limited according to the maximum power dissipation.

6 Typical 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)

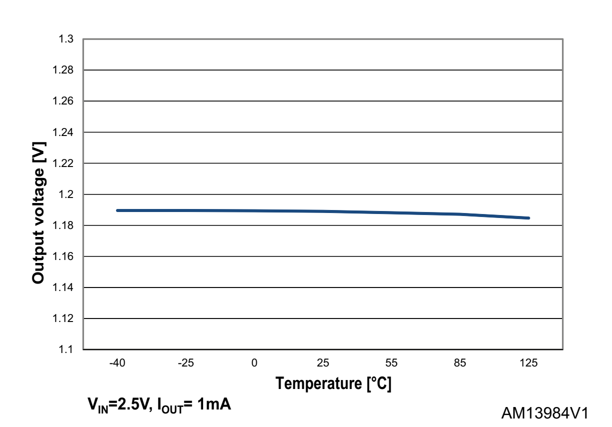


Figure 6. Output voltage vs. temperature (V_{OUT}=V_{ADJ}, I_{OUT}=200 mA)

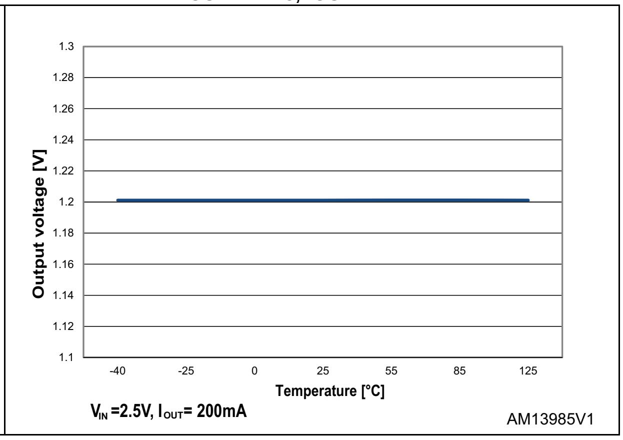


Figure 7. Output voltage vs. temperature (V_{OUT}=3.3 V, I_{OUT}=1 mA)

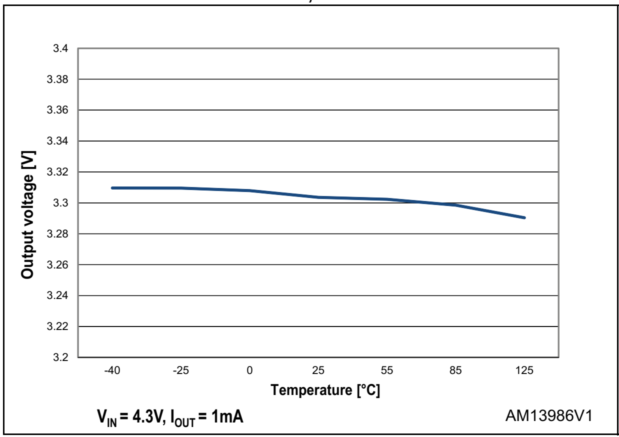


Figure 8. Output voltage vs. temperature (V_{OUT}=3.3 V, I_{OUT}=200 mA)

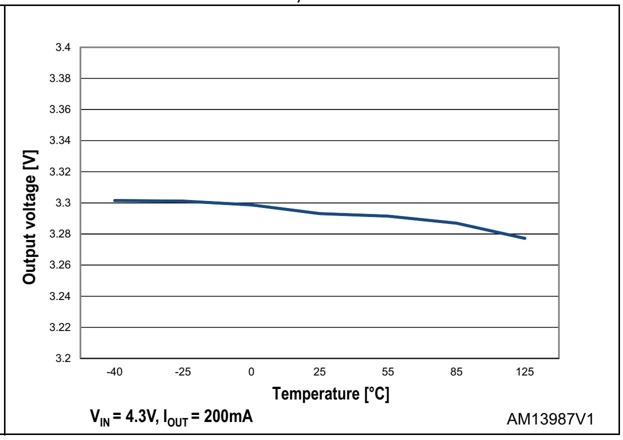


Figure 9. Short-circuit current vs. temperature

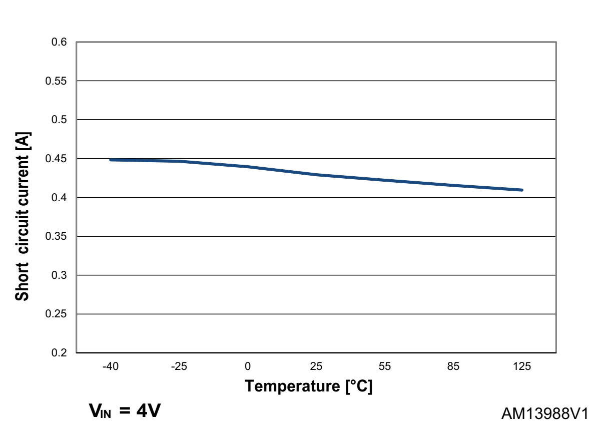


Figure 10. Line regulation vs. temperature (V_{OUT}=3.3 V)

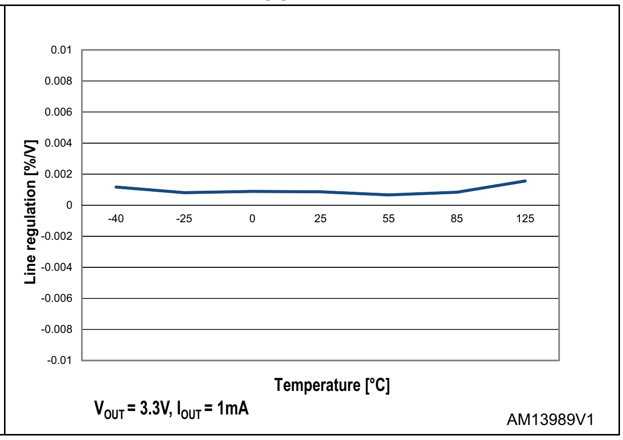


Figure 11. Line regulation vs. temperature (V_{OUT}=V_{ADJ})

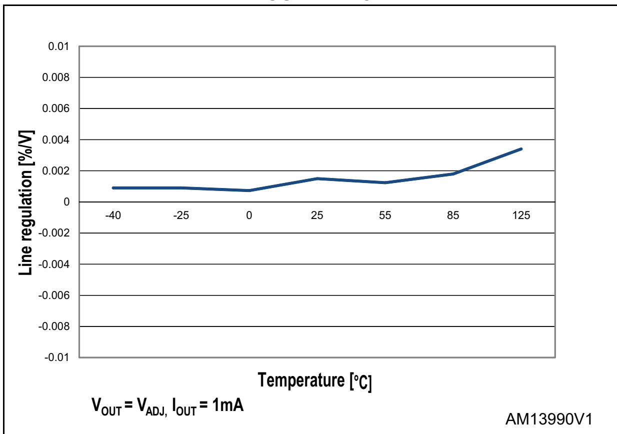


Figure 12. Load regulation vs. temperature (V_{OUT}=3.3 V)

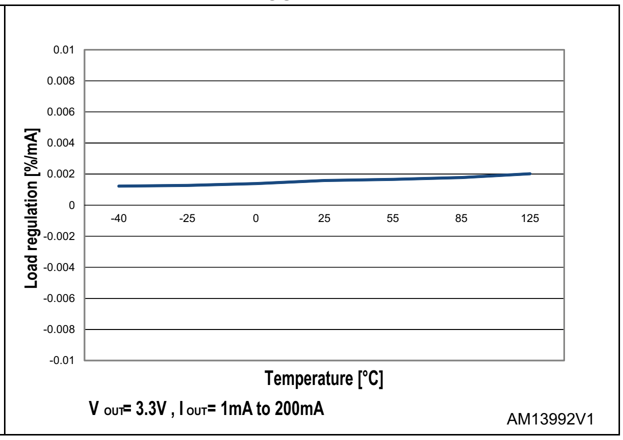


Figure 13. Load regulation vs. temperature (V_{OUT}=V_{ADJ})

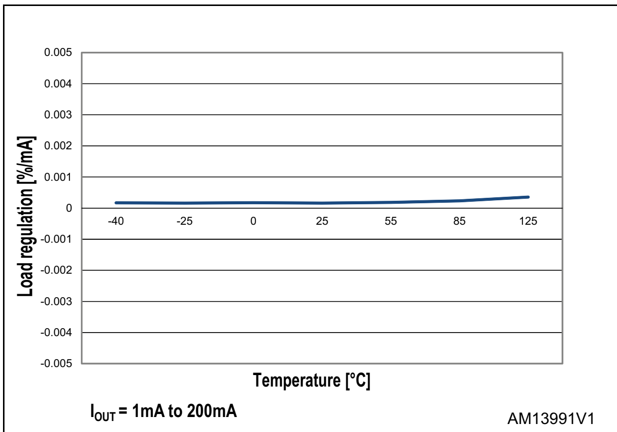


Figure 14. Enable thresholds vs. temperature

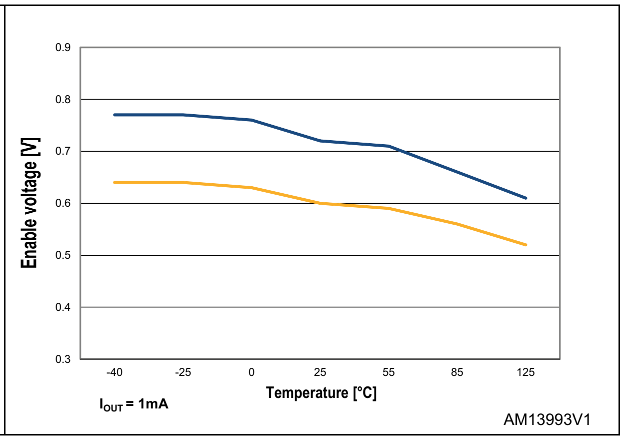


Figure 15. Dropout voltage vs. temperature

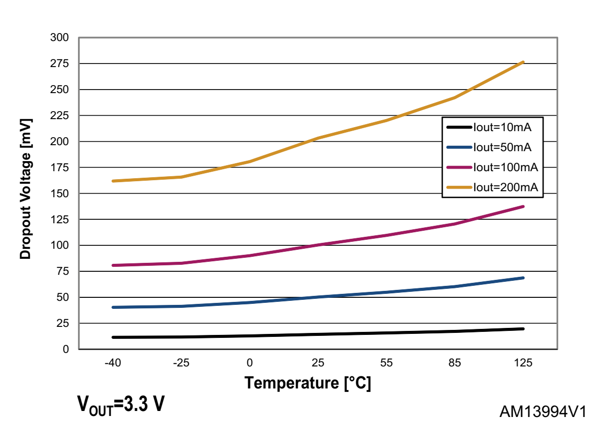


Figure 16. Quiescent current vs. temperature (I_{OUT}=0 mA)

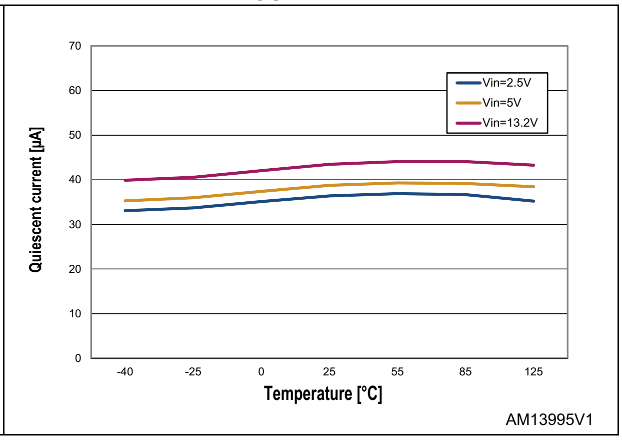


Figure 17. Quiescent current vs. temperature (I_{OUT}=200 mA)

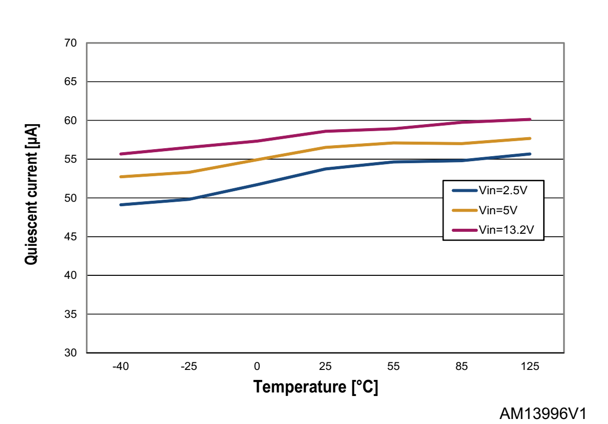


Figure 18. Off-state current vs. temperature

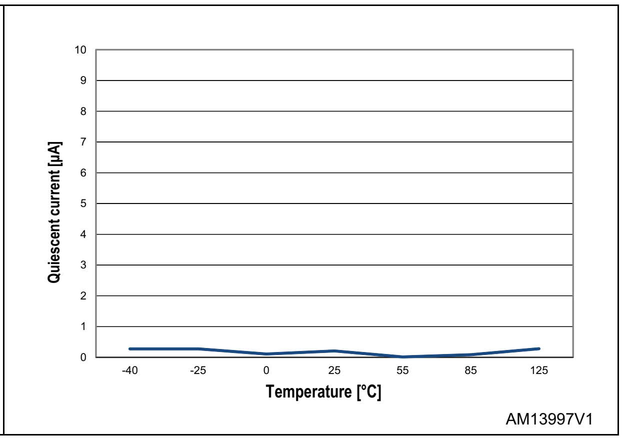


Figure 19. SVR vs. frequency (V_{OUT}=3.3 V)

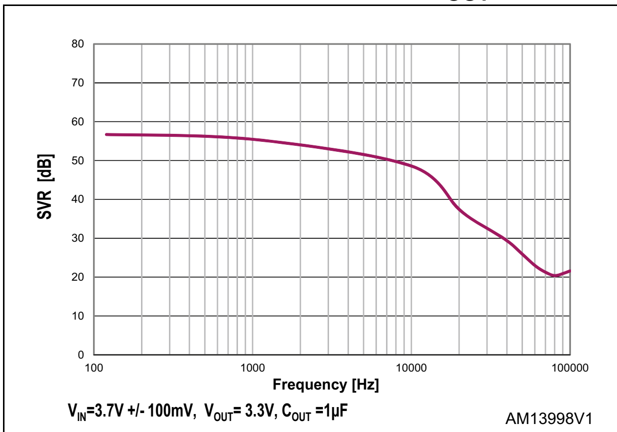


Figure 20. SVR vs. frequency (V_{OUT}=V_{ADJ})

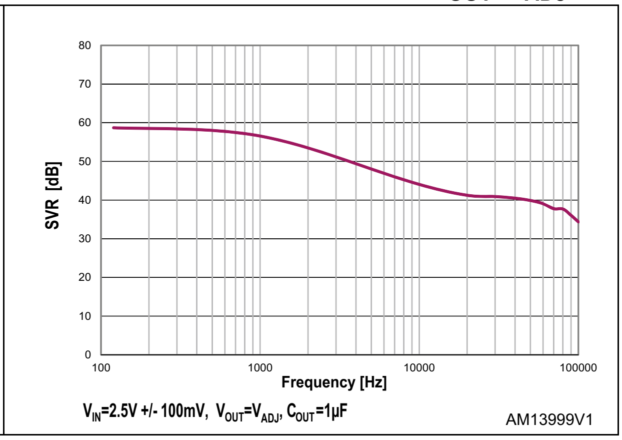
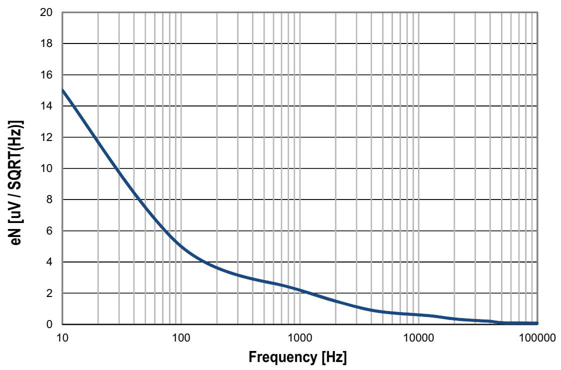


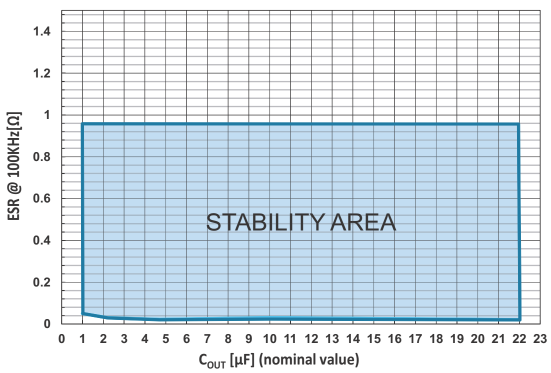
Figure 21. Output noise spectral density



V_{OUT} = 3.3V, C_{IN} = C_{OUT} =1µF

AM14000V1

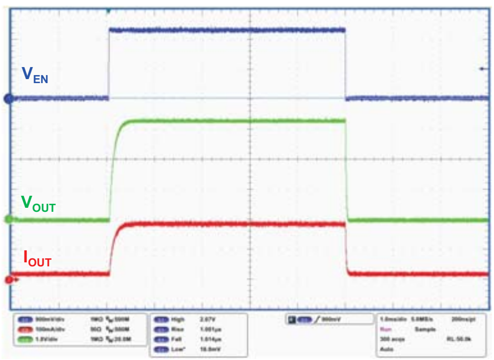
Figure 22. Stability vs. (C_{OUT}, ESR)



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

AM14001V1

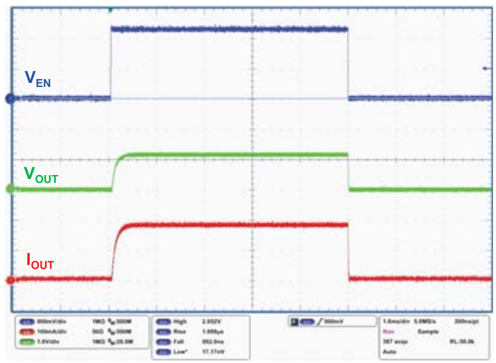
Figure 23. Startup with enable (V_{OUT}=3.3 V)



V_{IN}=4.3V, V_{EN}= 0V to 2V, I_{OUT}=0.2A, V_{OUT}=3.3V, T_r=T_f =1µs

AM14002V1

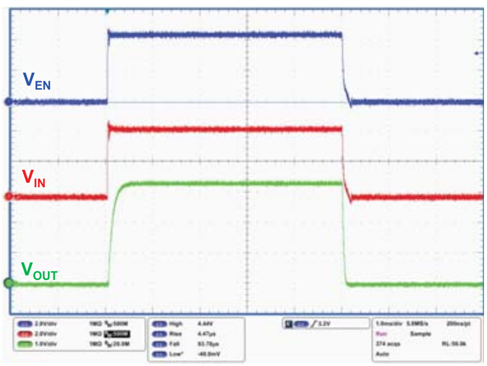
Figure 24. Startup with enable (V_{OUT}=V_{ADJ})



V_{IN}=2.5V, V_{EN}= 0V to V_{IN}, I_{OUT}=0.2A, V_{OUT} = V_{ADJ} , T_r=T_f =1µs

AM14003V1

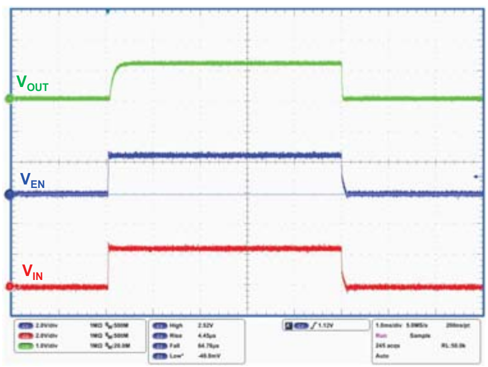
Figure 25. Turn-on time (V_{OUT}=3.3 V)



V_{IN}= V_{EN}= 0V to 4.3V, I_{OUT}=0.2A, V_{OUT} = 3.3V , T_r= 5µs

AM14004V1

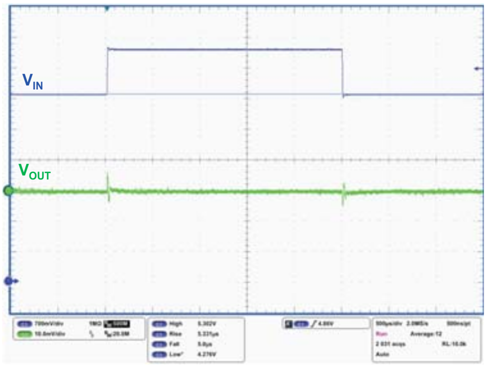
Figure 26. Turn-on time (V_{OUT}=V_{ADJ})



V_{IN}= V_{EN}= 0V to 2.5V, I_{OUT}=0.2A, V_{OUT} = V_{ADJ} , T_r= 5µs

AM14005V1

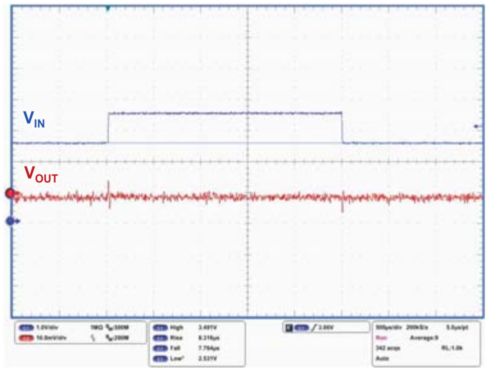
Figure 27. Line transient (V_{OUT}=3.3 V)



V_{IN}= V_{EN}= 4.3V to 5.3V, I_{OUT}= 1mA, V_{OUT} = 3.3V , T_r= T_f =5µs

AM14006V1

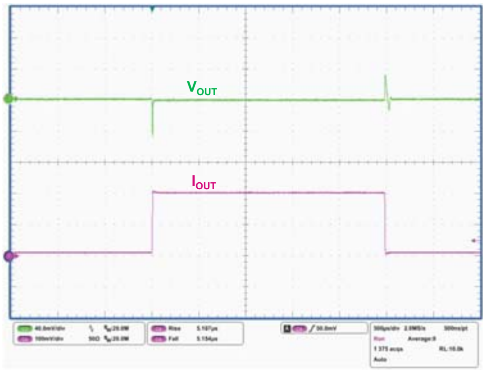
Figure 28. Line transient (V_{OUT}=V_{ADJ})



V_{IN}= V_{EN}= 2.5V to 3.5V, I_{OUT}= 1mA, V_{OUT} = V_{ADJ}, T_r= T_f =5µs

AM14007V1

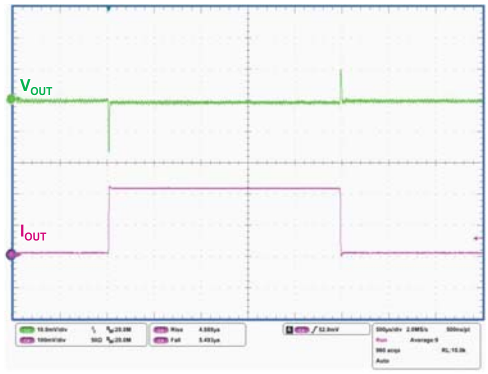
Figure 29. Load transient (V_{OUT}=3.3 V)



V_{IN}= V_{EN}= 4.3V , I_{OUT}= 1mA to 0.2A, V_{OUT} = 3.3V, T_r= T_f =5µs

AM14008V1

Figure 30. Load transient (V_{OUT}=V_{ADJ})



V_{IN}= V_{EN}= 2.5V , I_{OUT}= 1mA to 0.2A, V_{OUT} = V_{ADJ}, T_r= T_f =5µs

AM14009V1

7 Package mechanical data

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.

Figure 31. SOT23-5L drawings

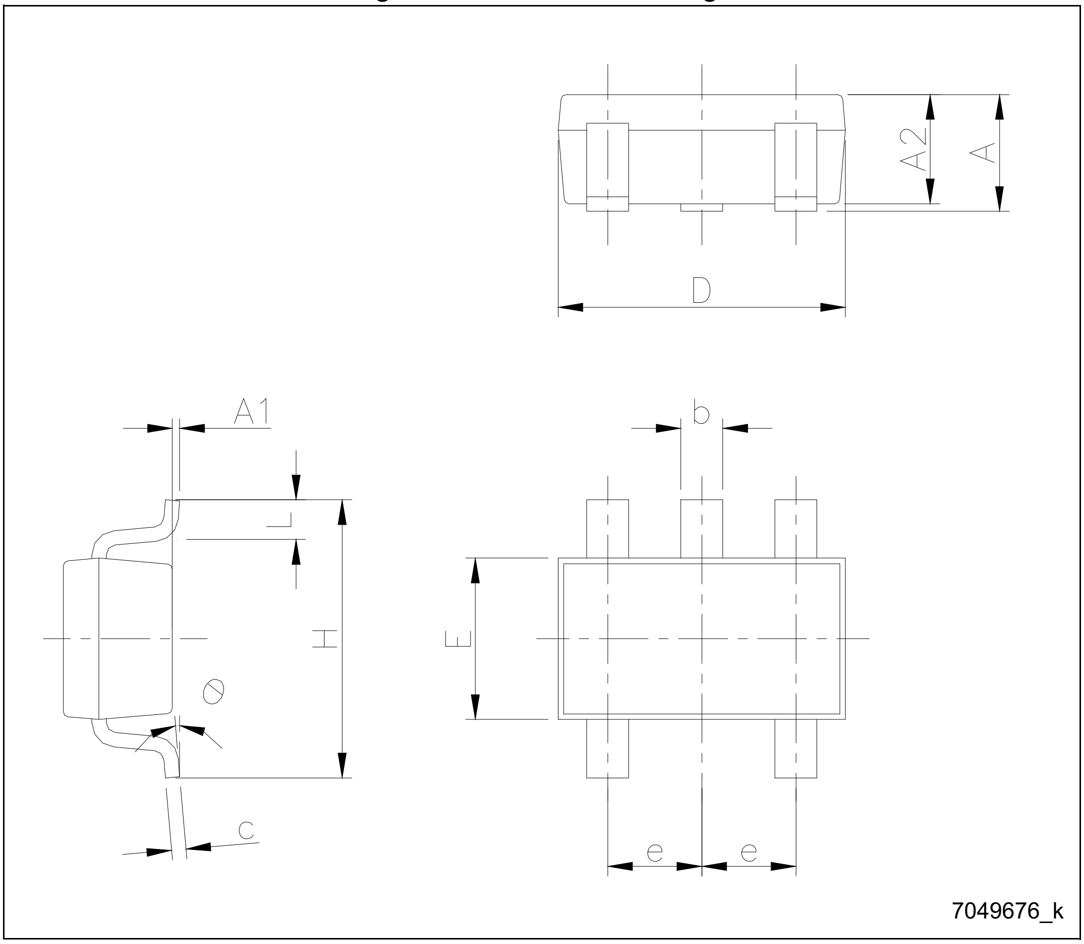


Table 7. SOT23-5L mechanical data

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	2.09		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 in mm)

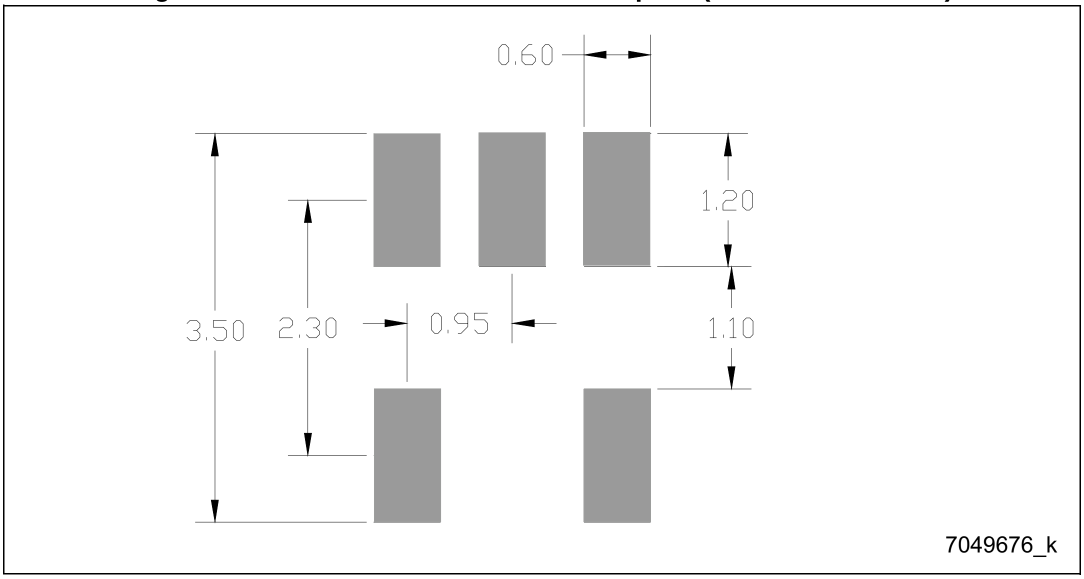


Figure 33. SOT323-5L drawings

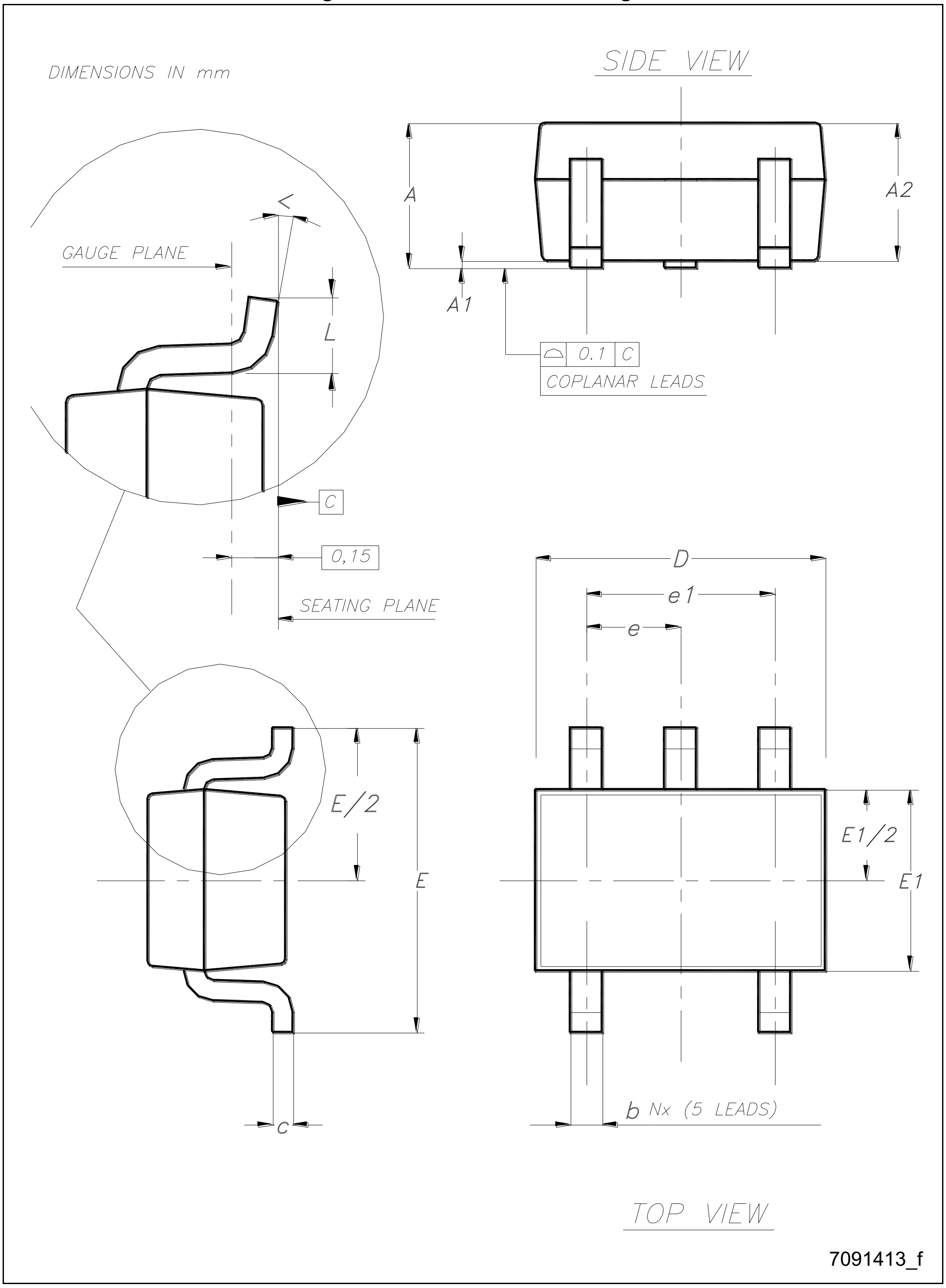


Table 8. SOT323-5L mechanical data

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	0.36	0.46
<	0°		8°

Figure 34. DFN6-1.2x1.3 drawings

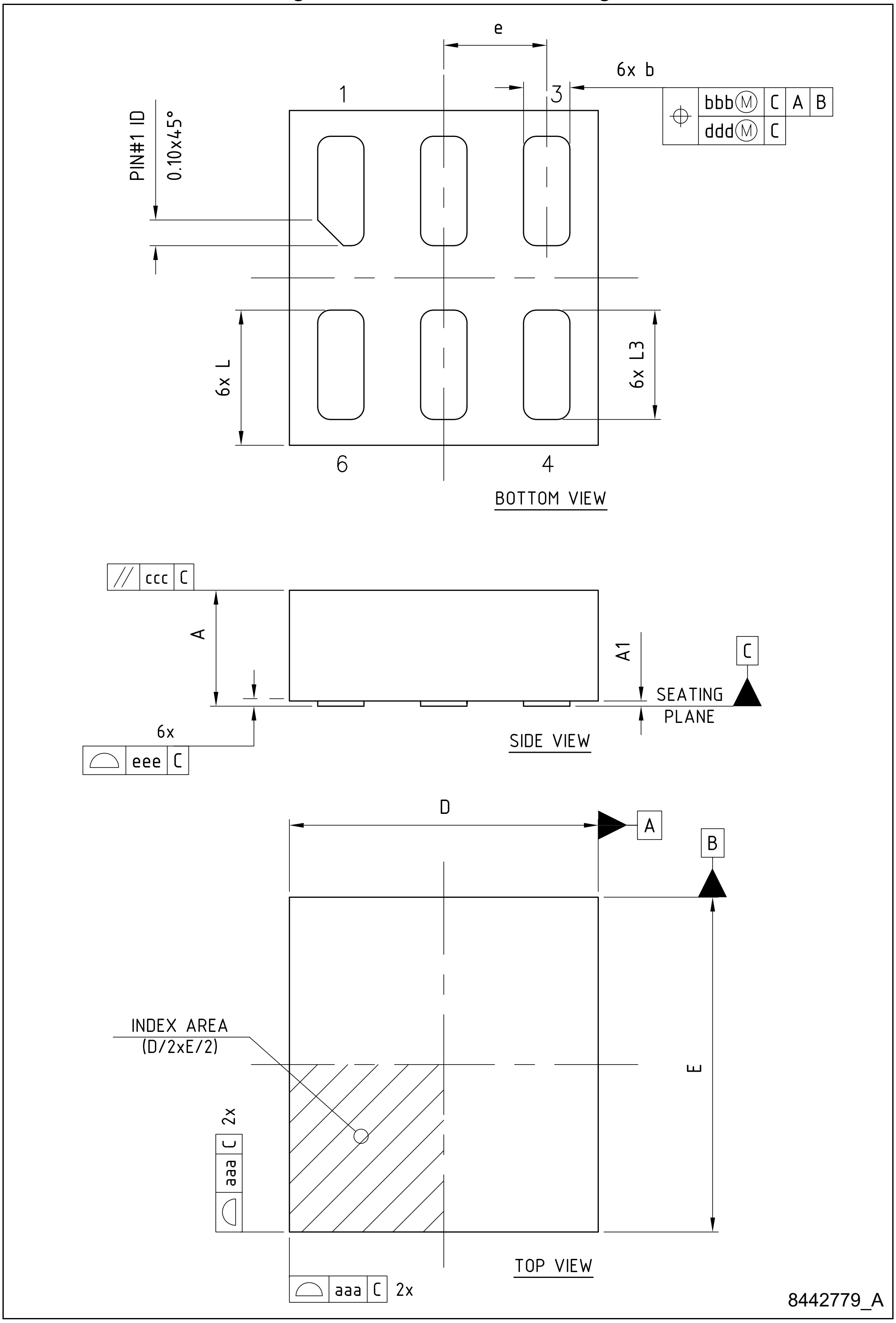
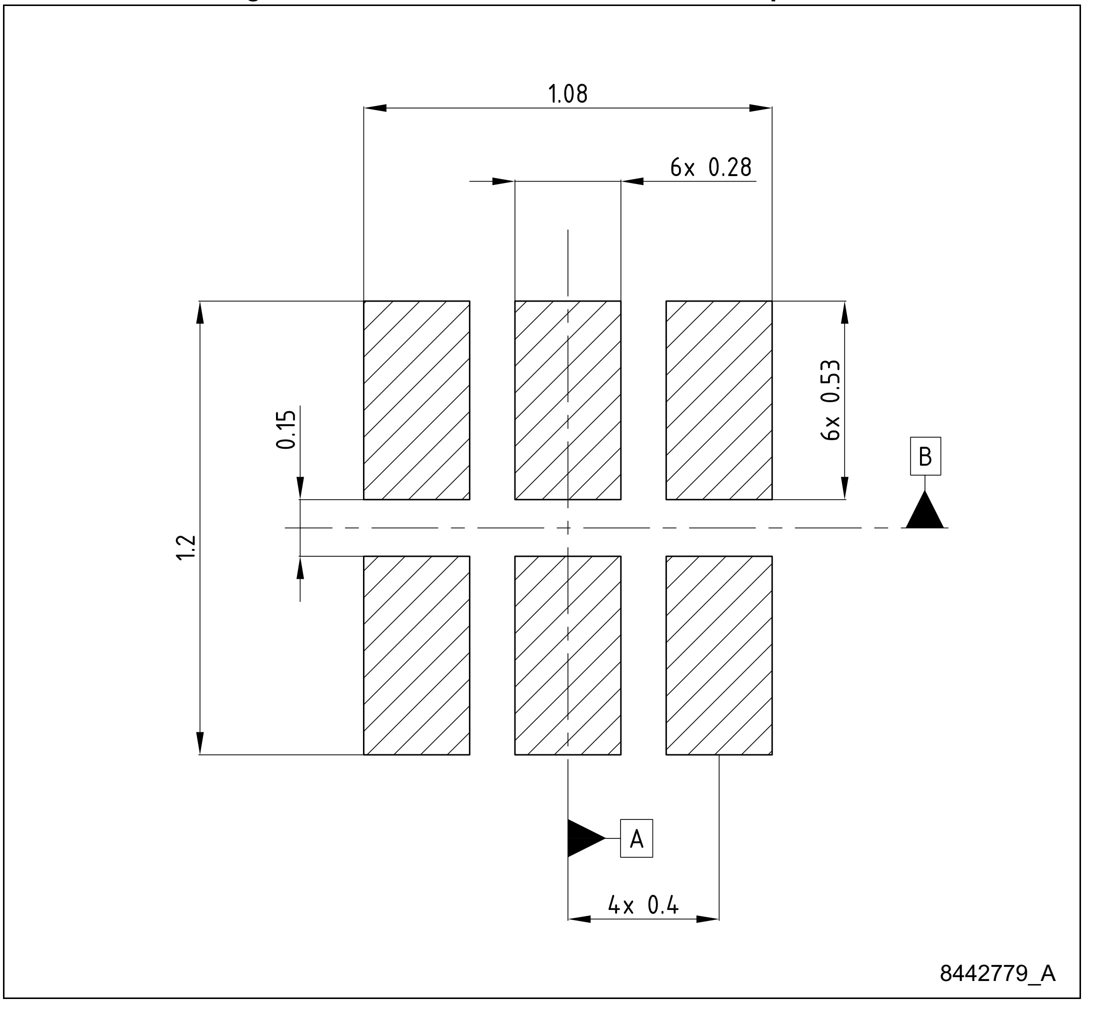


Table 9. DFN6-1.2x1.3 mechanical data

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 35. DFN6-1.2x1.3 recommended footprint [a]



a. Dimensions are in mm.

8 Ordering information

Table 10. Order codes

SOT323-5L	SOT23-5L	DFN6	Output voltage (V)
LDK220C12R	LDK220M12R	LDK220PU12R	1.2
LDK220C13R	LDK220M13R	LDK220PU13R	1.3
LDK220C15R	LDK220M15R	LDK220PU15R	1.5
LDK220C18R	LDK220M18R	LDK220PU18R	1.8
LDK220C25R	LDK220M25R	LDK220PU25R	2.5
LDK220C27R	LDK220M27R	LDK220PU27R	2.7
LDK220C28R	LDK220M28R	LDK220PU28R	2.8
LDK220C30R	LDK220M30R	LDK220PU30R	3
LDK220C31R	LDK220M31R	LDK220PU31R	3.1
LDK220C32R	LDK220M32R	LDK220PU32R	3.2
LDK220C33R	LDK220M33R	LDK220PU33R	3.3
LDK220C36R	LDK220M36R	LDK220PU36R	3.6
LDK220C40R	LDK220M40R	LDK220PU40R	4
LDK220C42R	LDK220M42R	LDK220PU42R	4.2
LDK220C50R	LDK220M50R	LDK220PU50R	5
LDK220C60R	LDK220M60R	LDK220PU60R	6
LDK220C85R	LDK220M85R	LDK220PU85R	8.5
LDK220C90R	LDK220M90R	LDK220PU90R	9
LDK220C-R	LDK220M-R	LDK220PU-R	adj

9 Revision history

Table 11. Document revision history

Date	Revision	Changes
19-Mar-2014	1	Initial release.