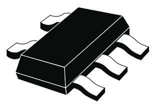
life.augmented

LDK130

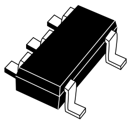
300 mA low quiescent current very low noise LDO

Datasheet - production data



SOT23-5L

DFN6 (1.2 x 1.3 mm)



SOT323-5L

Features

- Input voltage from 1.9 to 5.5 V
- Very low dropout voltage (100 mV typ. at 100 mA load)
- Low quiescent current (max. 120 µA, 1 µA in OFF mode)
- Very low noise
- Output voltage tolerance: ± 2.0 % @ 25 °C
- 300 mA guaranteed output current
- Wide range of fixed output voltages available on request: from 0.8 V to 3.5 V with 100 mV step
- Adjustable version: from 0.8 V to V_{IN}-V_{drop}
- 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 (1.2 x 1.3 mm) packages
- Temperature range: -40 °C to 125 °C

Applications

- Mobile phones
- Personal digital assistants (PDAs)
- Cordless phones and similar battery-powered systems
- Digital still cameras

Description

The LDK130 low drop voltage regulator provides 300 mA of maximum current from an input supply voltage in the range of 1.9 V to 5.5 V, with a typical dropout voltage of 100 mV.

It is stabilized with a ceramic capacitor on the output.

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

An enable logic control function puts the LDK130 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.

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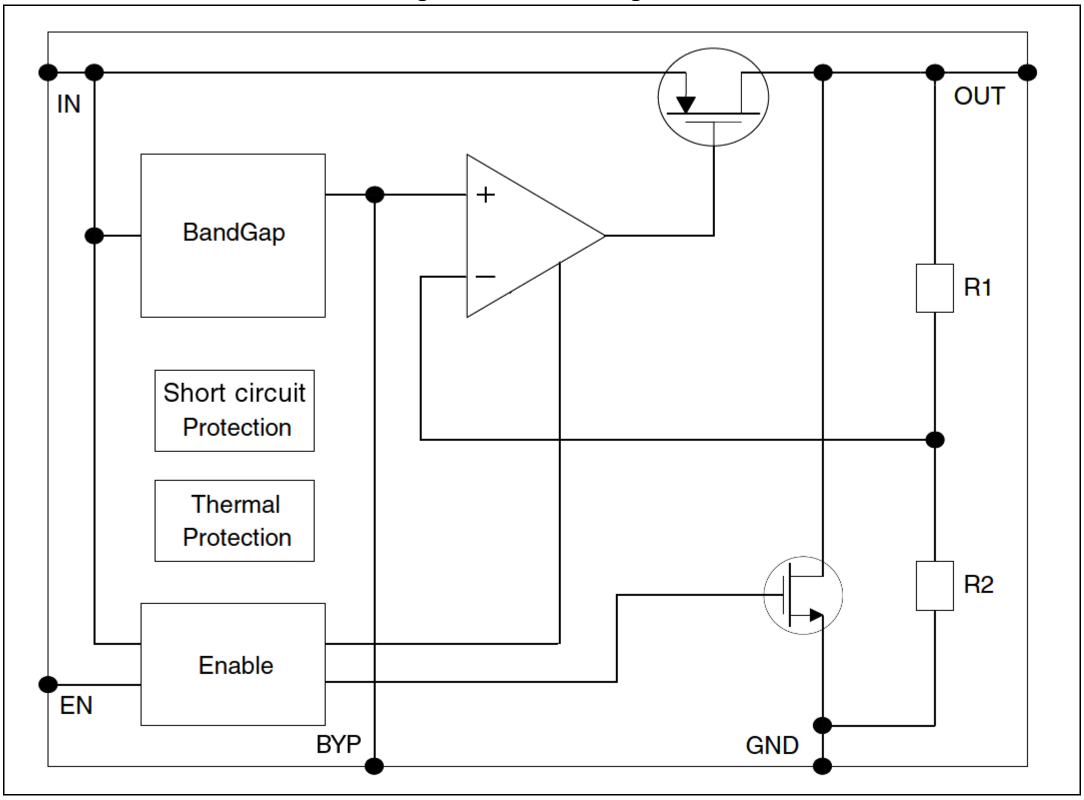
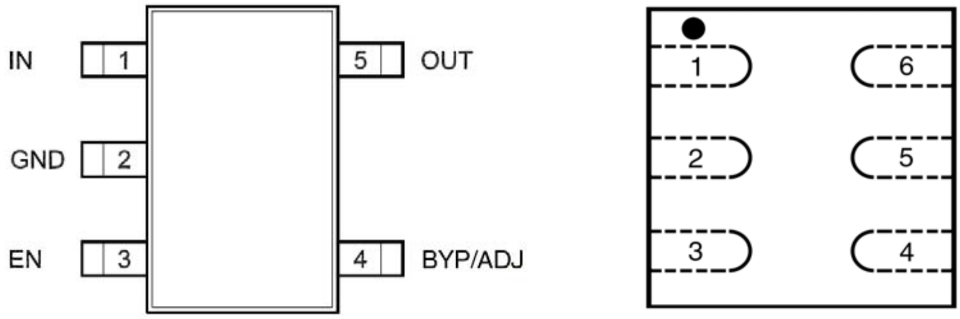
1 Diagram

Figure 1. Block diagram



2 Pin configuration

Figure 2. Pin connection (top view)



SOT23-5L, SOT323-5L

DFN6 (1.2 x 1.3)

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

Pin		Symbol	Function
SOT23/ SOT323	DFN6		
1	6	IN	Input voltage of the LDO
2	2	GND	Common ground
3	4	EN	Enable pin logic input: Low = shutdown, High = active
4	3	BYP[1]/ADJ	Bypass capacitor on fixed versions, Adjustable pin on ADJ versions
5	1	OUT	Output voltage of the LDO
-	5	N/C	Not connected. This pin should be connected to GND

1. Bypass capacitor for noise reduction on fixed version is optional, if not used the relevant pin must be left floating with no routing on the board.

3 Typical application

Figure 3. Typical application circuits for fixed version

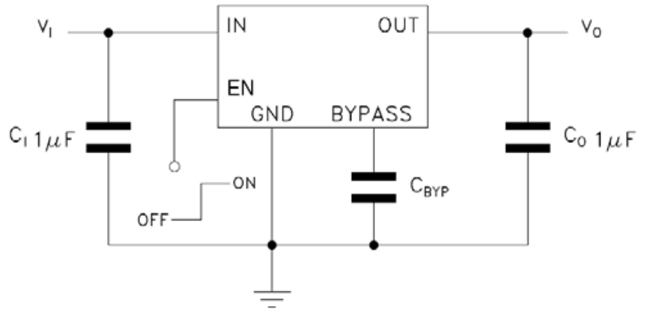
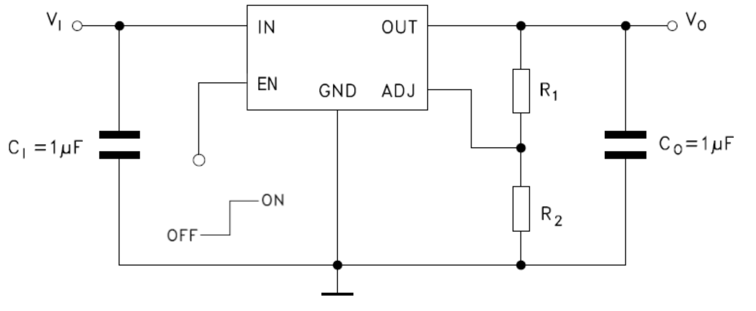


Figure 4. Typical application circuits for adjustable version



$$V_O = V_{ADJ}\ (1 + R_1/R_2)$$

4 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{IN}	DC input voltage	- 0.3 to 7	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
$V_{BYP/ADJ}$	ADJ/Bypass pin voltage	2	V
I_{OUT}	Output current	Internally limited	mA
P_D	Power dissipation	Internally limited	mW
T_{STG}	Storage temperature range	- 65 to 150	°C
T_{OP}	Operating junction temperature range	- 40 to 125	°C

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 3. Thermal data

Symbol	Parameter	SOT23-5L	SOT323-5L	DFN-6L	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 4. Electrical characteristics for LDK130 (fixed version)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage		1.9		5.5	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} ≤ 5.5 V, I_{OUT}=1 mA		0.05		%/V
ΔV_{OUT}	Static load regulation	I_{OUT} = 1 mA to 300 mA		0.006		%/mA
V_{DROP}	Dropout voltage [(1)]	I_{OUT} = 100 mA, V_{OUT}=2.5 V		100		mV
		I_{OUT} = 300 mA, V_{OUT}=2.5 V 40 °C<T_J<125 °C		200	400	
e_N	Output noise voltage	10 Hz to 100 kHz, I_{OUT}=10 mA, V_{OUT}=2.5 V, C_{BYP}=10 nF		51		μV_{RMS}/V
SVR	Supply voltage rejection	V_{IN}=V_{OUTNOM}+0.5 V+/-V_{RIPPLE} V_{RIPPLE}=0.1 V Freq.=120 Hz to 10 kHz I_{OUT}=10 mA		55		dB
I_Q	Quiescent current	I_{OUT}=0 mA, -40 °C<T_J<125 °C		30	60	µA
		I_{OUT}=300 mA, -40 °C<T_J<125 °C		70	120	
		V_{IN} input current in OFF mode: V_{EN}=GND			1	
I_{SC}	Short-circuit current	R_L=0		450		mA
V_{EN}	Enable input logic low	V_{IN}=1.9 V to 5.5 V, -40 °C<T_J<125 °C			0.4	V
	Enable input logic high	V_{IN}=1.9 V to 5.5 V, -40 °C<T_J<125 °C	1.2			
I_{EN}	Enable pin input current	V_{SHDN}=V_{IN}			100	nA
T_{SHDN}	Thermal shutdown			160		°C
	Hysteresis			20		
C_{OUT}	Output capacitor	Capacitance (see *Section 6: Typical performance 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_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. Electrical characteristics for LDK130 (adjustable version)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage		1.9		5.5	V
V_{ADJ}	V_{ADJ} accuracy	I_{OUT}=1 mA, T_J=25 °C	784	800	816	mV
		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} ≤ 5.5 V, I_{OUT}=1 mA		0.05		%/V
ΔV_{OUT}	Static load regulation	I_{OUT}=1 mA to 300 mA		0.006		%/mA
V_{DROP}	Dropout voltage (1)	I_{OUT}=100 mA, V_{OUT}=2.5 V		100		mV
		I_{OUT} = 300 mA, V_{OUT}=2.5 V 40 °C<T_J<125 °C,		200	400	
e_N	Output noise voltage	10 Hz to 100 kHz, I_{OUT}=10 mA		130		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 Freq.=120 Hz to 10 kHz I_{OUT}=10 mA		55		dB
I_Q	Quiescent current	I_{OUT}=0 mA, -40 °C<T_J<125 °C		30	60	µA
		I_{OUT}=300 mA, -40 °C<T_J<125 °C		70	120	
		V_{IN} input current in OFF mode: V_{EN}=GND			1	
I_{SC}	Short-circuit current	R_L=0		450		mA
V_{EN}	Enable input logic low	V_{IN}=1.9 V to 5.5 V, -40 °C<T_J<125 °C			0.4	V
	Enable input logic high	V_{IN}=1.9 V to 5.5 V, -40 °C<T_J<125 °C	1.2			
I_{EN}	Enable pin input current	V_{SHDN}=V_{IN}			100	nA
T_{SHDN}	Thermal shutdown			160		°C
	Hysteresis			20		
C_{OUT}	Output capacitor	Capacitance (see *Section 6: Typical performance 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.

6 Typical performance characteristics

$C_{IN} = C_{OUT} = 1\ \mu F$, V_{EN} to V_{IN}, unless otherwise specified.

Figure 5. Output voltage vs. temp. for adjustable (I_O = 1 mA)

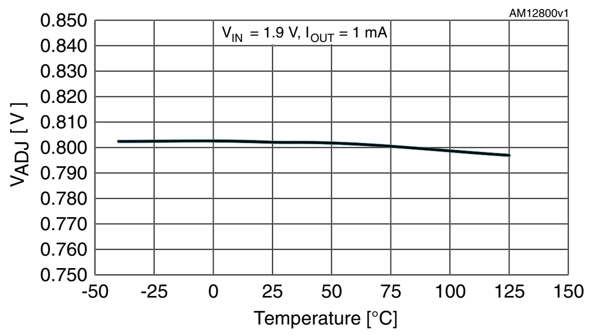


Figure 6. Output voltage vs. temp. for adjustable version (I_O = 300 mA)

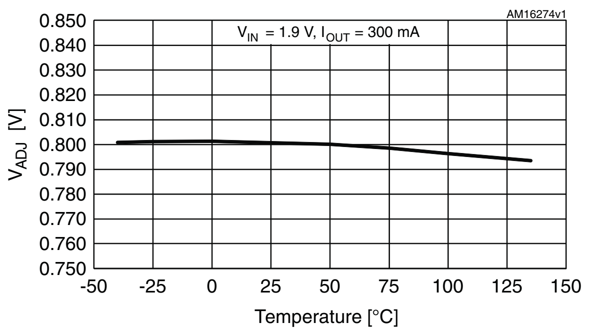


Figure 7. Output voltage vs. temp. for fixed version (I_O = 1 mA)

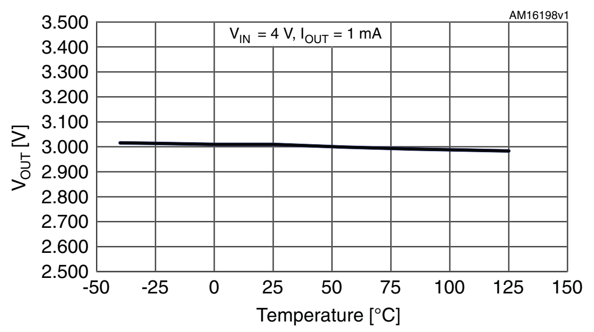


Figure 8. Output voltage vs. temp. for fixed version (I_O = 300 mA)

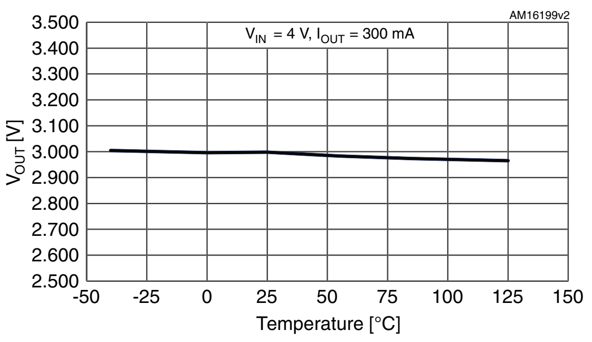


Figure 9. Line regulation vs. temp. for adjustable version

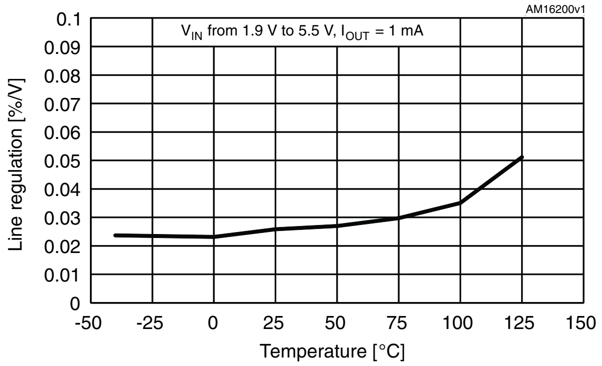


Figure 10. Short-circuit current vs. temp. for adjustable version

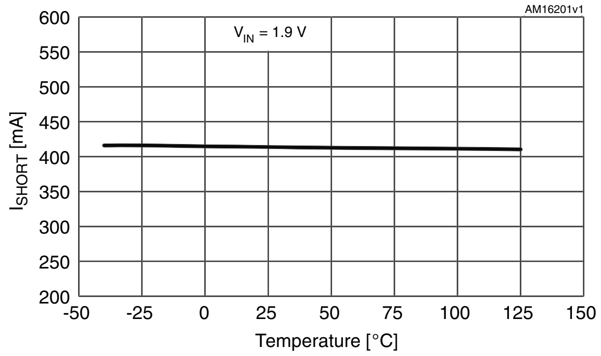


Figure 11. Load regulation vs. temp. for adjustable version

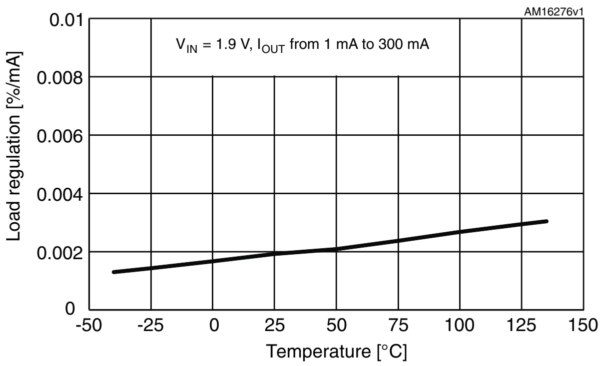


Figure 12. Load regulation vs. temp. for fixed version

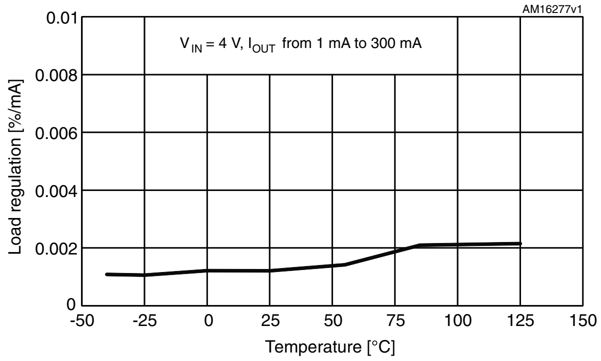


Figure 13. Enable pin thresholds vs. temp. (V_{IN} = 1.9 V)

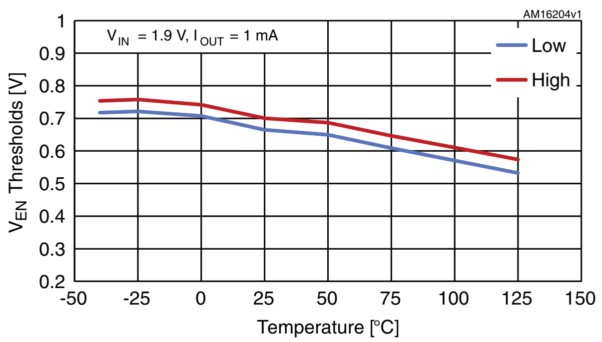


Figure 14. Enable pin thresholds vs. temp.

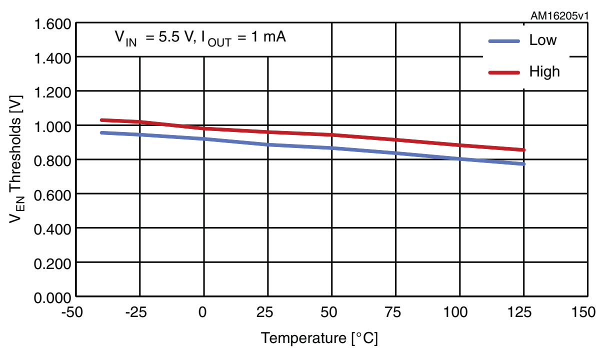


Figure 15. Quiescent current vs. temp. for adjustable version (I_O = 0 mA)

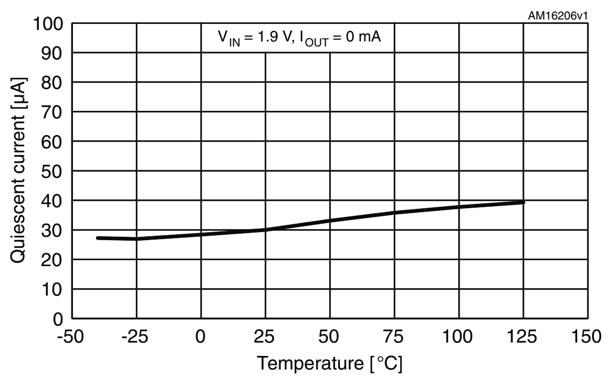


Figure 16. Quiescent current vs. temp. for adjustable version (I_O = 300 mA)

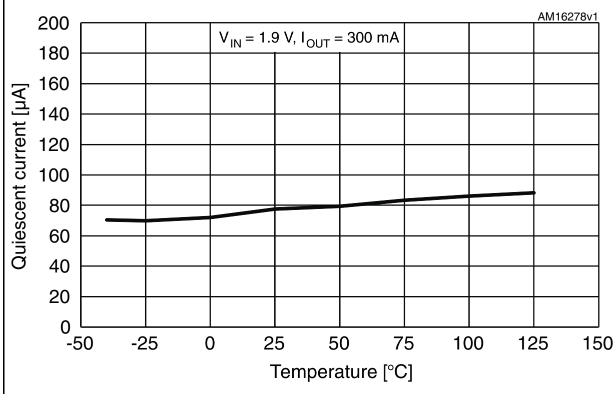


Figure 17. Quiescent current vs. temp. for fixed version (I_O = 0 mA)

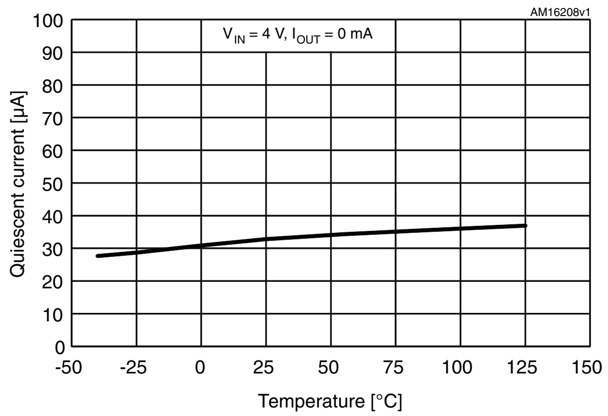


Figure 18. Quiescent current vs. temp. for fixed version (I_O = 300 mA)

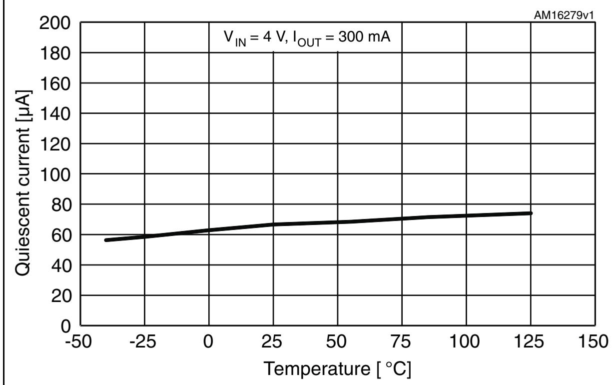


Figure 19. Shutdown current vs. temperature

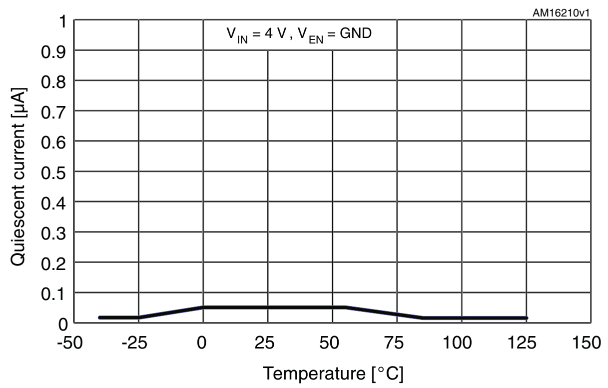


Figure 20. SVR vs. frequency (V_O = 2.5 V)

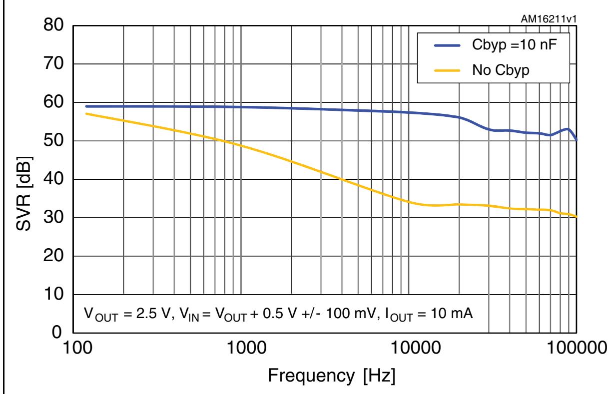


Figure 21. SVR vs. frequency ($V_O = V_{ADJ}$)

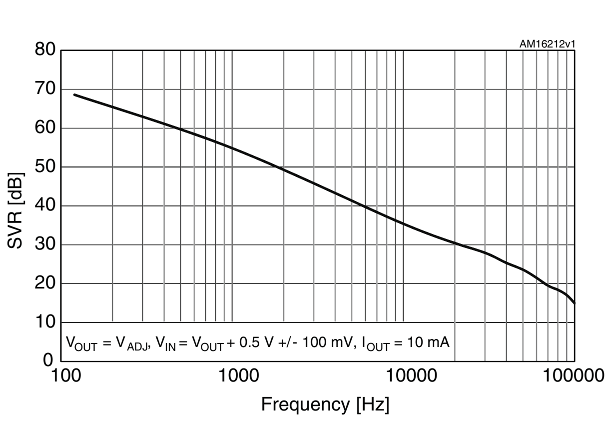


Figure 22. Output noise vs. frequency (V_O = 3.3 V)

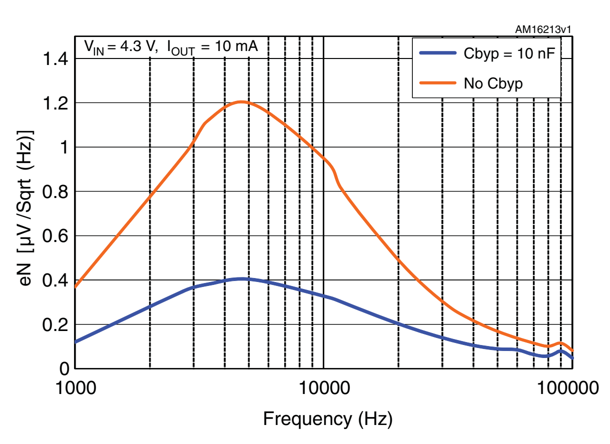


Figure 23. Output noise vs. frequency ($V_O = V_{ADJ}$)

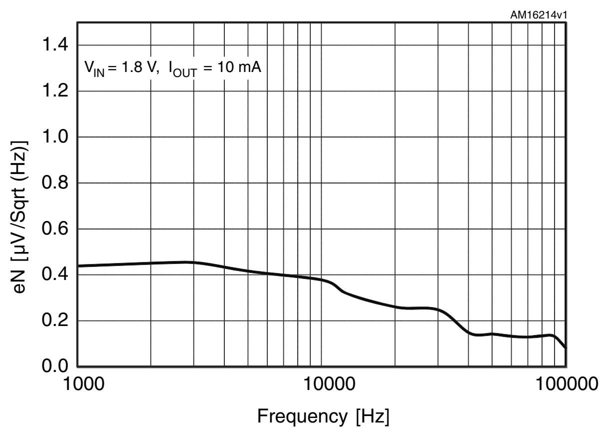
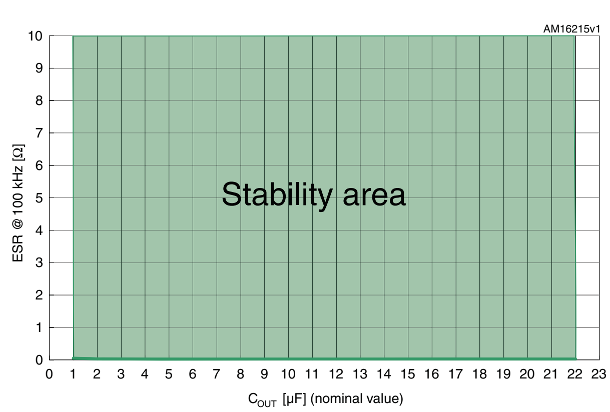
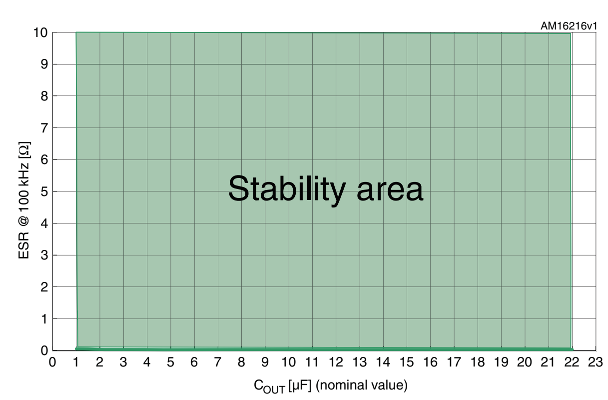


Figure 24. Stability region vs. C_{OUT} (fixed)



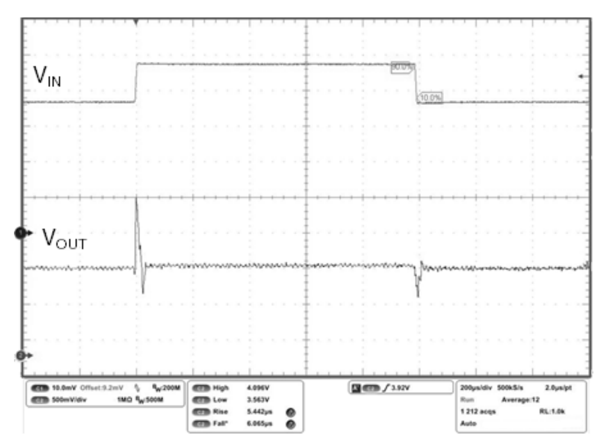
$V_{IN} = V_{EN}$ = 4 to 5.5 V, I_{OUT} = 10 mA to 0.3 A, C_{IN} = 1 µF, T_A = 25 °C

Figure 25. Stability region vs C_{OUT} (adjust.)



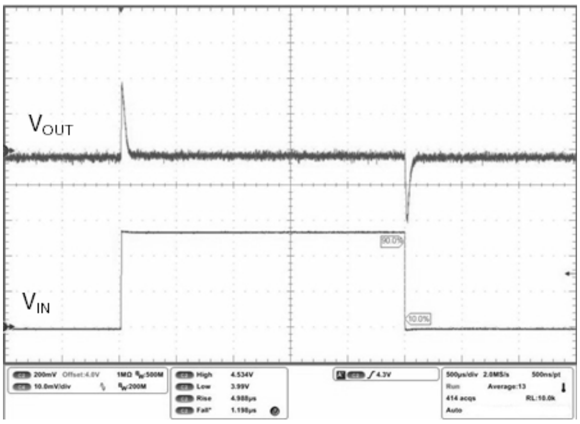
$V_{IN} = V_{EN}$ = 1.9 to 5.5 V, I_{OUT} = 10 mA to 0.3 A, C_{IN} = 1 µF, T_A = 25 °C

Figure 26. Line transient ($V_{OUT} = V_{ADJ}$)



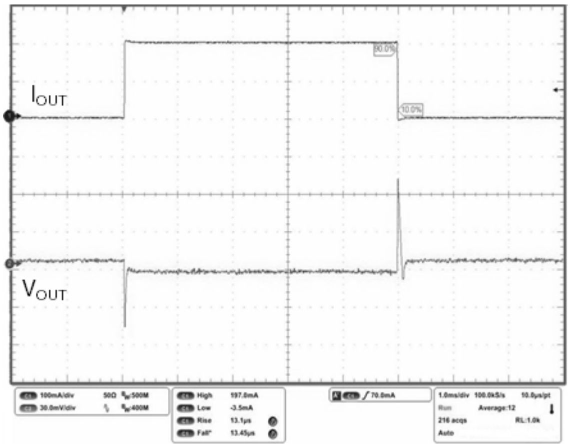
$V_{OUT} = V_{ADJ}$, V_{IN} = 3.5 V to 4 V, V_{EN} = 2 V, I_{OUT} = 1 mA, NO C_{IN}, C_{OUT} = 1 µF, $t_r = t_f$ = 5 µs

Figure 27. Line transient (V_{OUT} = 3 V)



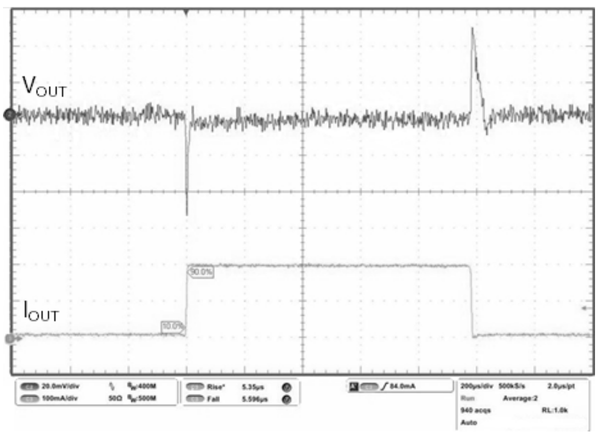
V_{OUT} = 3 V, V_{IN} = 4 V to 4.5 V, V_{EN} = 2 V, I_{OUT} = 1 mA, NO C_{IN}, C_{OUT} = 1 µF, t_r = t_f = 5 µs

Figure 28. Load transient (V_{OUT} = 3 V)



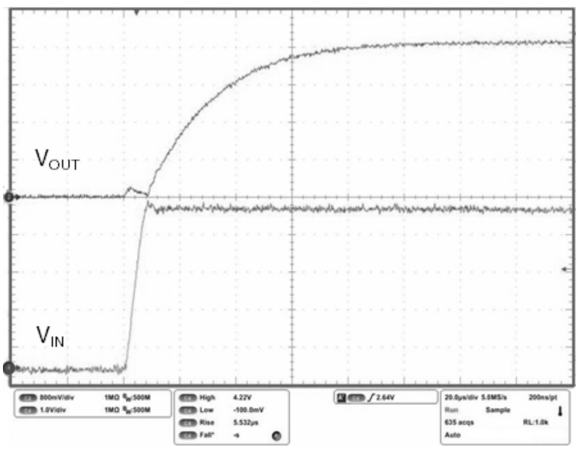
V_{OUT} = 3 V, V_{IN} = V_{EN} = 3.5 V, I_{OUT} = 1 mA to 200 mA, C_{OUT} = 1 µF, t_r = t_f = 5 µs

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



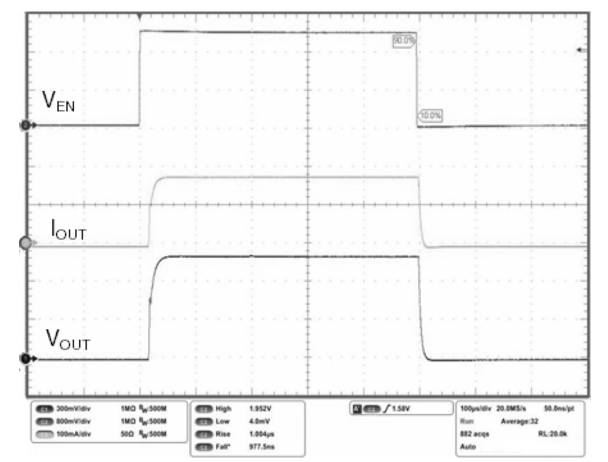
V_{OUT} = V_{ADJ}, V_{IN} = V_{EN} = 3.5 V, I_{OUT} = 1 mA to 200 mA, C_{OUT} = 1 µF, t_r = t_f = 5 µs

Figure 30. Startup transient



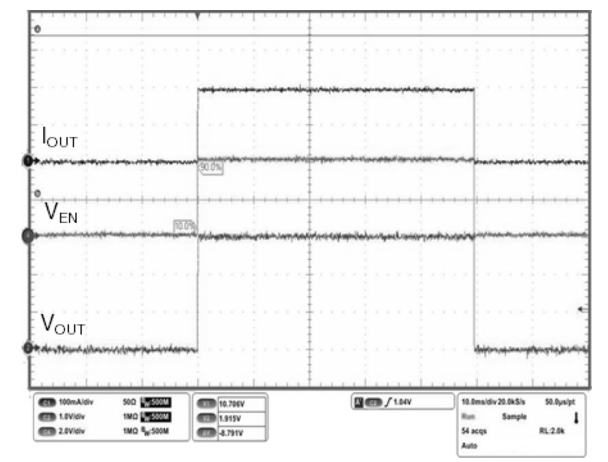
V_{OUT} = 3 V, V_{IN} = V_{EN} = 0 to 4.2 V, I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 1 µF, t_r = t_f = 5 µs

Figure 31. Enable transient ($V_{OUT} = V_{ADJ}$)



V_{OUT} @ 0.8 V, V_{IN} = 1.9, V_{EN} = 0 to V_{IN}, I_{OUT} = 200 mA, C_{OUT} = 1 µF, $t_r = t_f$ = 1 µs

Figure 32. Enable transient (V_{OUT} = 3 V)



V_{IN} = 4 V, V_{EN} = 0 to V_{IN}, I_{OUT} = 200 mA, $C_{IN} = C_{OUT}$ = 1 µF, $t_r = t_f$ = 1 µs

Figure 33. Dropout voltage vs. temperature (I_{OUT} = 100 mA)

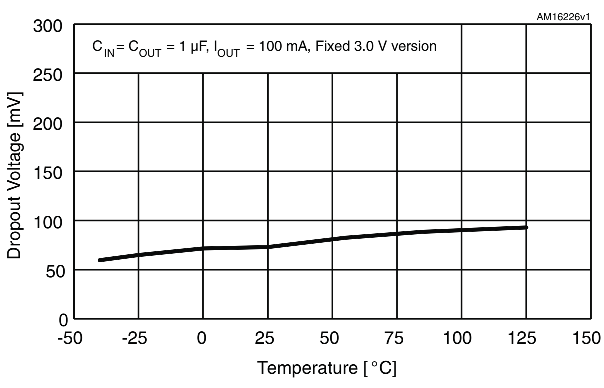
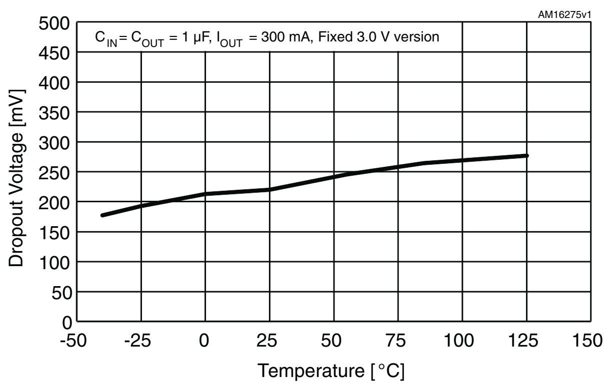


Figure 34. Dropout voltage vs. temperature (I_{OUT} = 300 mA)



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 35. SOT23-5L mechanical drawing

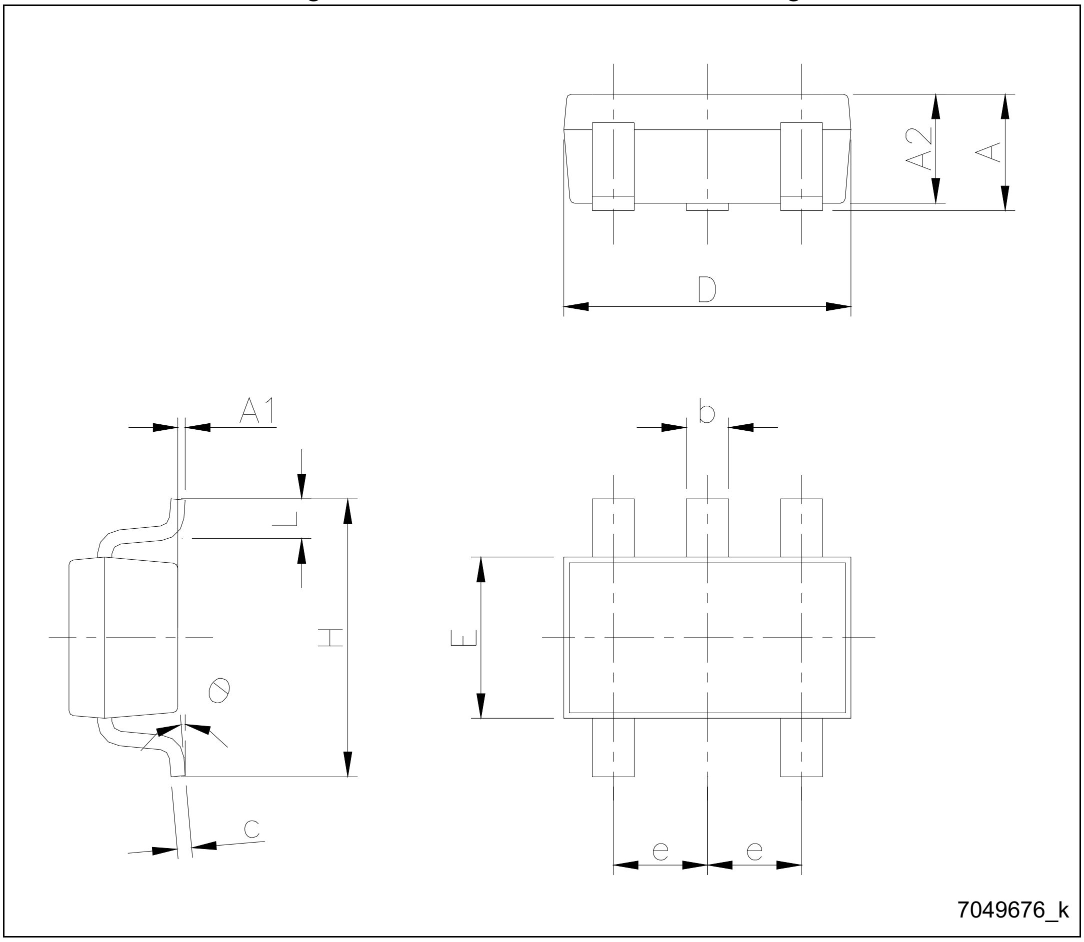


Table 6. SOT23-5L mechanical data

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 36. SOT23-5L footprint (dimensions in mm)

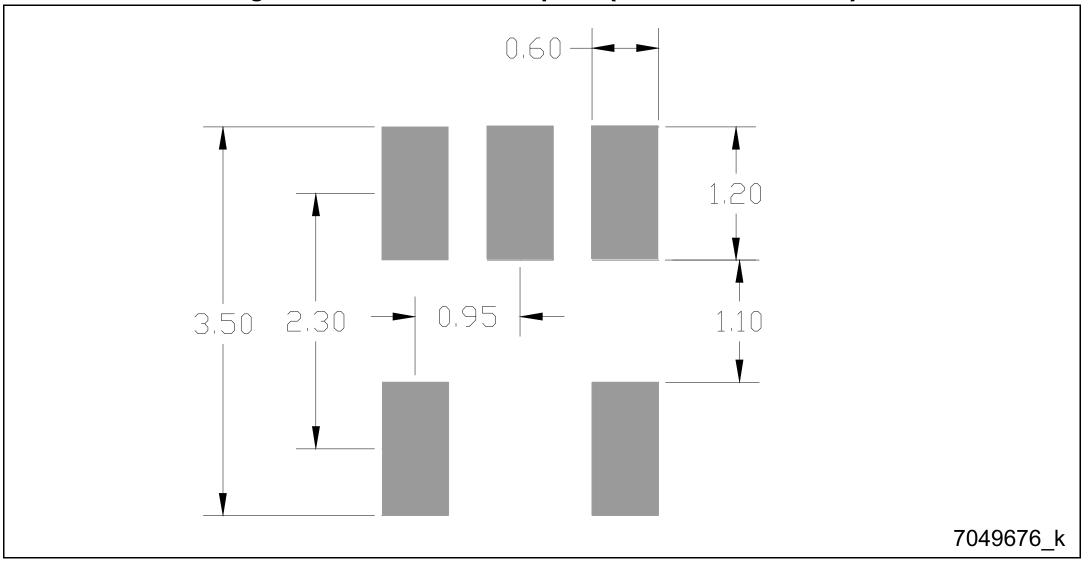


Figure 37. DFN6L (1.2 x 1.3 mm) drawing

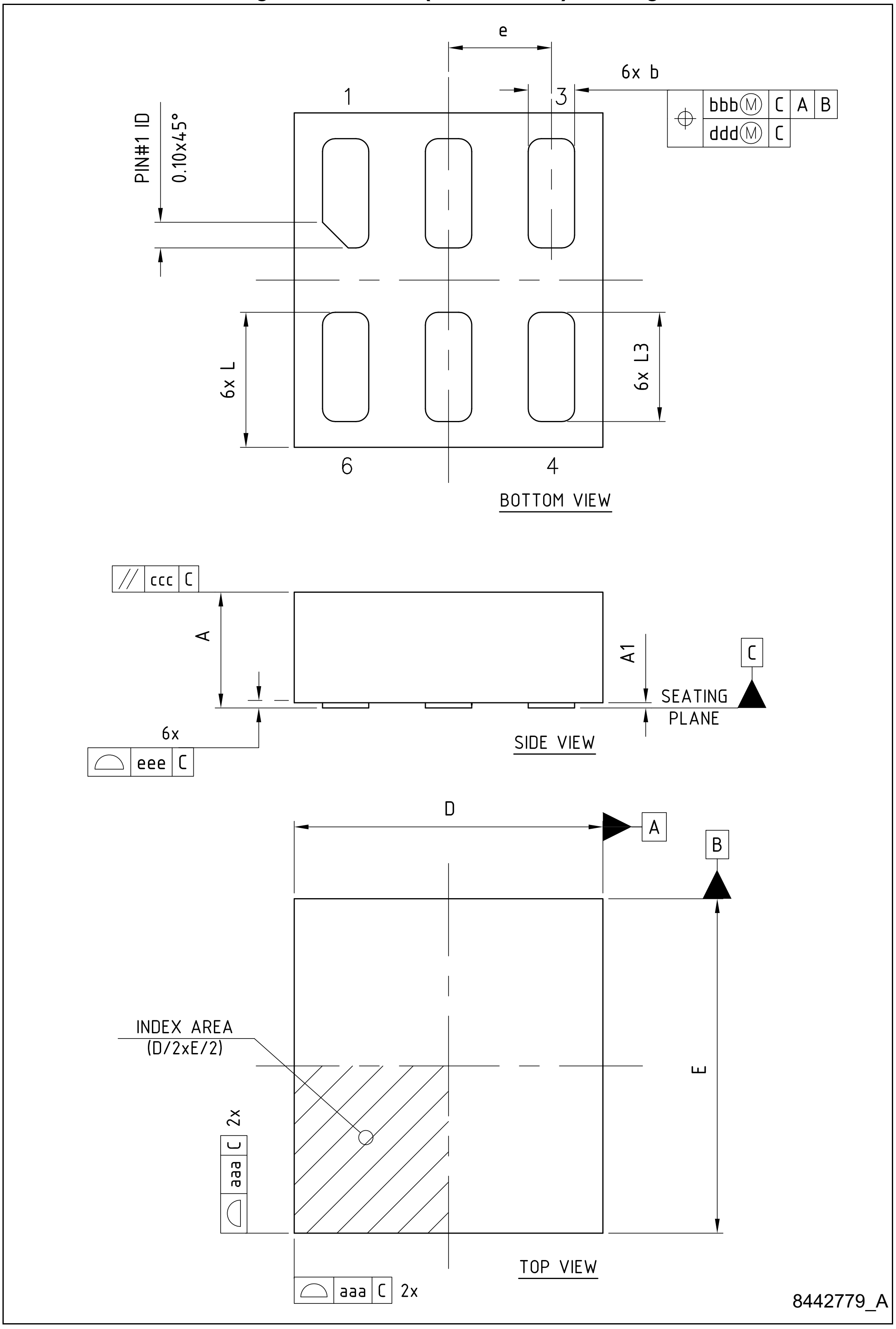


Table 7. DFN6L (1.2 x 1.3 mm) mechanical data

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	-

Figure 38. DFN6L footprint (dimensions in mm)

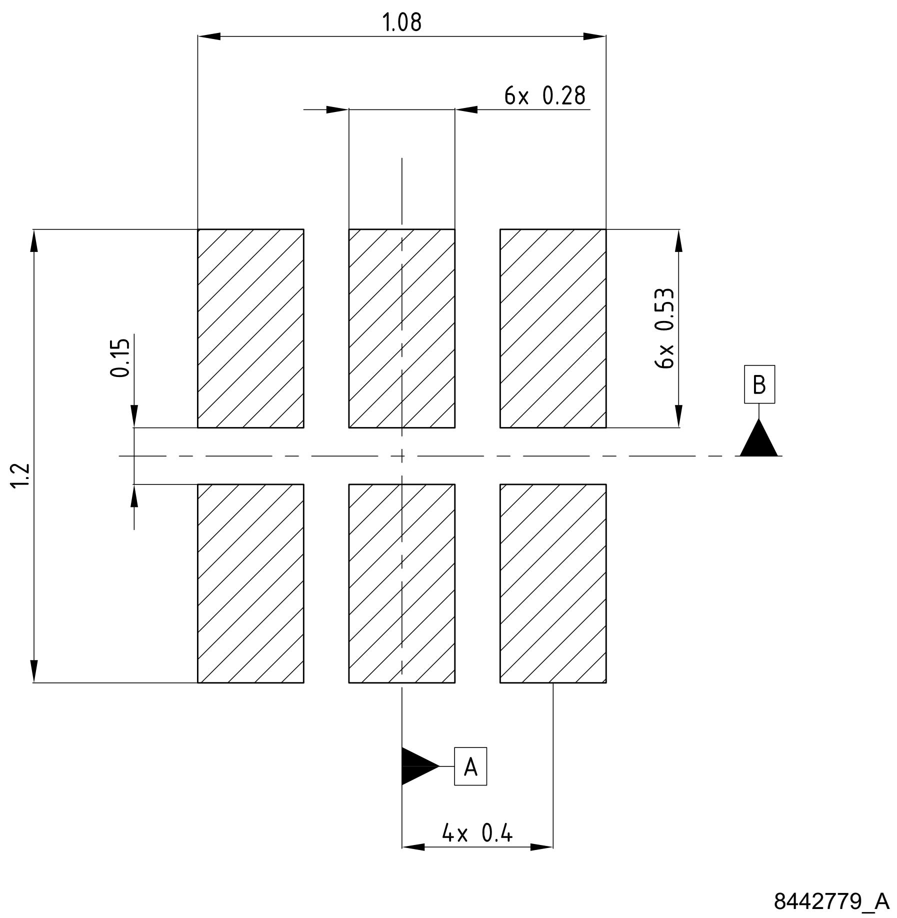


Figure 39. SOT323-5L drawing

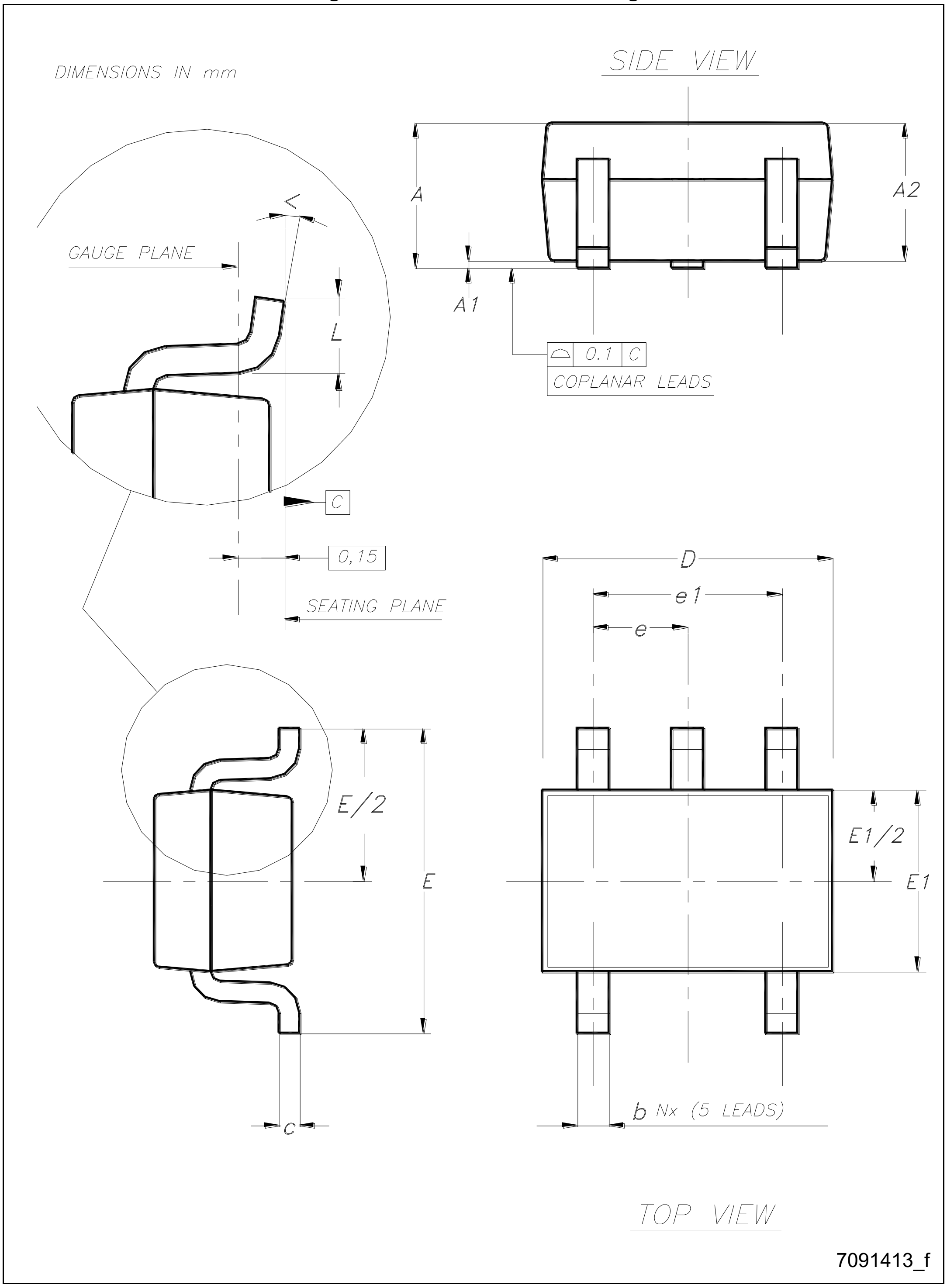


Table 8. SOT323-5L mechanical data

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°

8 Packaging mechanical data

Figure 40. TSOT23-5L and SOT323-xL tape and reel drawing

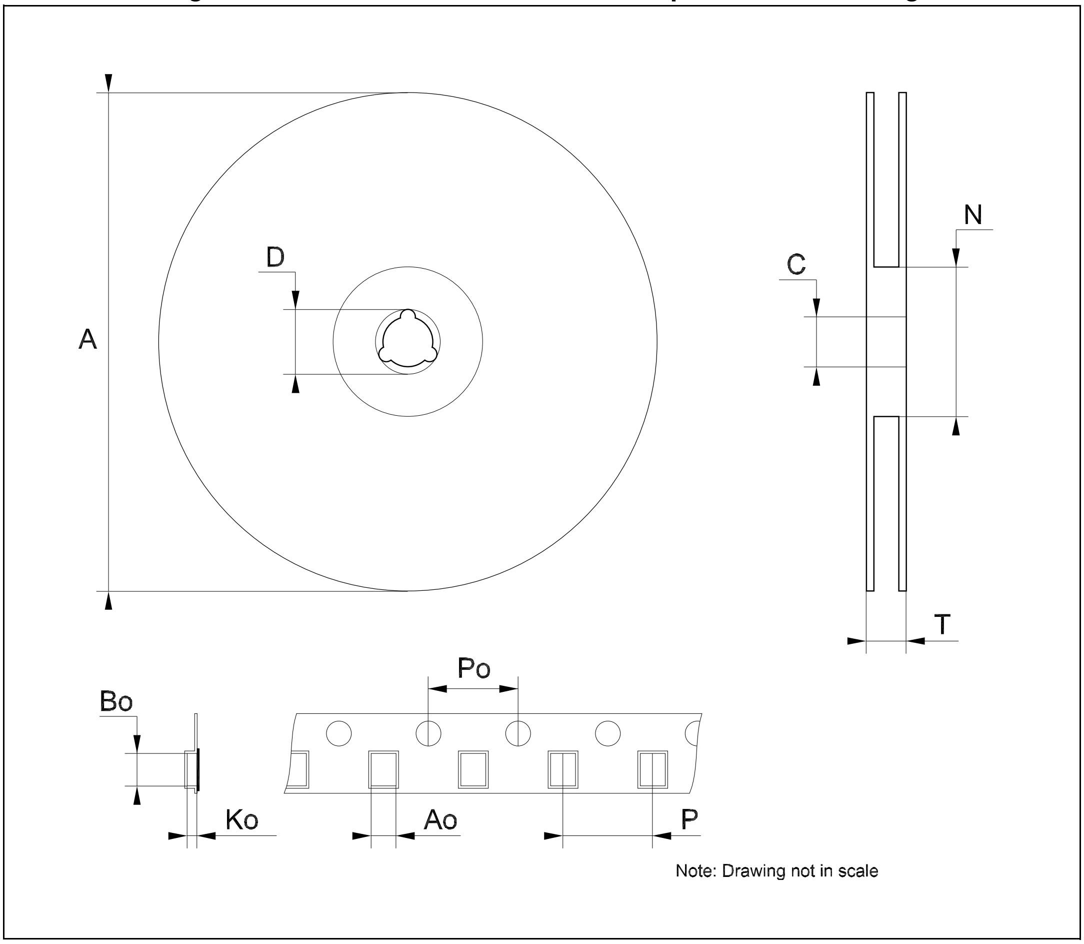


Table 9. SOT23-5L tape and reel mechanical data

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

Table 10. SOT323-xL tape and reel mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	175	180	185
C	12.8	13	13.2
D	20.2		
N	59.5	60	60.5
T			14.4
Ao		2.25	
Bo		3.17	
Ko		1.2	
Po	3.9	4.0	4.1
P	3.9	4.0	4.2

9 Order codes

Table 11. Order codes

Packages			Output voltages
SOT323-5L	SOT23-5L	DFN6L	
LDK130C-R	LDK130M-R	LDK130PU-R	ADJ
LDK130C08R	LDK130M08R	LDK130PU08R	0.8 V
LDK130C10R	LDK130M10R	LDK130PU10R	1 V
LDK130C12R	LDK130M12R	LDK130PU12R	1.2 V
LDK130C15R	LDK130M15R	LDK130PU15R	1.5 V
LDK130C18R	LDK130M18R	LDK130PU18R	1.8 V
	LDK130M25R	LDK130PU25R	2.5 V
LDK130C29R	LDK130M29R	LDK130PU29R	2.9 V
		LDK130PU30R	3 V
LDK130C32R	LDK130M32R	LDK130PU32R	3.2 V
LDK130C33R	LDK130M33R	LDK130PU33R	3.3 V

Table 12. Marking

Order codes	Packages	Output voltages	Marking
LDK130MxxR	SOT23-5L	xx V	Kxx
LDK130CxxR	SOT323-5L	xx V	Kxx
LDK130PUxxR	DFN-6L	xx V	xx
LDK130M-R	SOT23-5L	Adj	KAD
LDK130C-R	SOT323-5L	Adj	KAD
LDK130PU-R	DFN-6L	Adj	AD

10 Revision history

Table 13. Document revision history

Date	Revision	Changes
31-Jan-2013	1	Initial release
25-Oct-2013	2	RPN LDK130xx changed to LDK130. Updated the Features and the Description in cover page. Cancelled Table1: Device summary. Updated *Section 7: Package mechanical data*, *Table 2: Absolute maximum ratings* and *Table 11: Order codes*. Added *Section 8: Packaging mechanical data*. Minor text changes.
10-Mar-2014	3	Updated *Table 11: Order codes*.