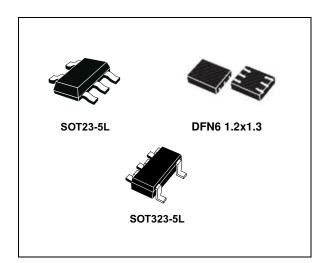


300 mA low quiescent current very low noise LDO (automotive for SOT23-5L package)

Datasheet - production data



Features



- AEC-Q100 qualified (automotive grade 1, SOT23-5L package)
- Input voltage from 1.9 to 5.5 V
- Very low-dropout voltage (100 mV typ. at 100 mA load)
- Low quiescent current (typ. 30 μA, 1 μA in OFF mode)
- Very low noise
- Output voltage tolerance: ± 2.0% at 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 1.2x1.3 packages
- Temperature range: -40 °C to 125 °C

Applications

- · Mobile phones
- Portable consumer and industrial devices
- Cordless phones and similar battery-powered systems
- Automotive P.O.L.
- A.D.A.S.

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 μ A.

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

Contents LDK130

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LDK130 Block diagram

1 Block diagram

Bandgap

Short-circuit protection

Thermal protection

Enable

EN

BYP

GND

Figure 1. Block diagram

Pin configuration LDK130

2 Pin configuration

IN 1 5 OUT 6 6 GND 2 5 T BYP/ADJ 3 C 4 DFN6 1.2 x 1.3

Figure 2. Pin connections (top view)

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

Pin			
SOT23/ SOT323	DFN6	Symbol	Function
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.

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LDK130 Typical application

3 Typical application

Figure 3. Typical application circuits for fixed version

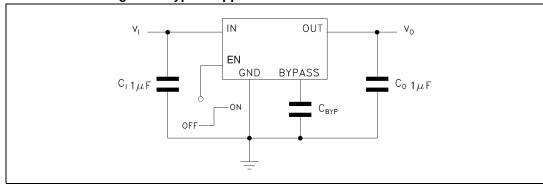
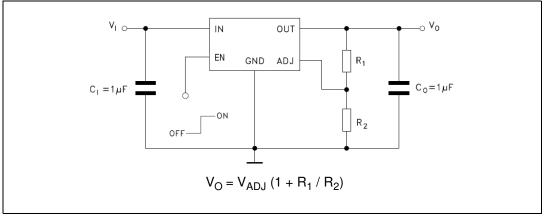


Figure 4. Typical application circuits for adjustable version



Maximum ratings LDK130

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	٧
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	DFN6	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 $\mu F,\ I_{OUT}$ = 1 mA, V_{EN} = $V_{IN},\ unless otherwise specified.$

Table 4. Electrical characteristics for LDK130 (fixed version)

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit	
V _{IN}	Operating input voltage	-	1.9	-	5.5	V	
	V accuracy	I _{OUT} = 1 mA, T _J = 25 °C	-2.0	-	2.0	%	
V _{OUT}	V _{OUT} accuracy	I _{OUT} = 1 mA, -40 °C < T _J < 125 °C	-3.0	-	3.0	%	
ΔV _{OUT}	Static line regulation	V_{OUT} +1 $V \le V_{IN} \le 5.5 \text{ V}$, $I_{OUT} = 1 \text{ mA}$	-	0.05	-	%/V	
ΔV _{OUT}	Static load regulation	I _{OUT} = 1 mA to 300 mA	-	0.006	-	%/mA	
		I_{OUT} = 100 mA, V_{OUT} = 2.5 V	-	100	-		
V _{DROP}	Dropout voltage ⁽¹⁾	$I_{OUT} = 300 \text{ mA}, V_{OUT} = 2.5 \text{ V}$ 40 °C < T_{J} < 125 °C	-	200	400	mV	
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	$V_{\text{IN}} = V_{\text{OUTNOM}} + 0.5 \text{ V} \pm V_{\text{RIPPLE}}$ $V_{\text{RIPPLE}} = 0.1 \text{ V} \text{ freq.} = 120 \text{ Hz to } 10 \text{ kHz}$ $I_{\text{OUT}} = 10 \text{ mA}$	-	55	-	dB	
		I_{OUT} = 0 mA, -40 °C < T_{J} < 125 °C	-	30	60		
ΙQ	Quiescent current	I_{OUT} = 300 mA, -40 °C < T_{J} < 125 °C	-	70	120	μΑ	
IQ		V_{IN} input current in OFF mode: $V_{EN} = GND$	-	-	1		
I _{SC}	Short-circuit current	R _L = 0	-	450	-	mA	
V	Enable input logic low	V_{IN} = 1.9 V to 5.5 V, -40 °C < T_J < 125 °C	-	-	0.4	V	
V _{EN}	Enable input logic high	V_{IN} = 1.9 V to 5.5 V, -40 °C < T_J < 125 °C	1.2	-		V	
I _{EN}	Enable pin input current	$V_{SHDN} = V_{IN}$	-	-	100	nA	
т.	Thermal shutdown	-	-	160	-	°C	
T _{SHDN}	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.



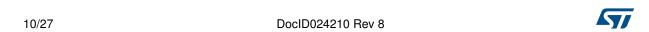
Electrical characteristics LDK130

 T_J = 25 °C, V_{IN} = $V_{OUT(NOM)}$ + 1 V, C_{IN} = C_{OUT} = 1 $\mu\text{F},~I_{OUT}$ = 1 mA, V_{EN} = $V_{IN},$ unless otherwise specified.

Table 5. Electrical characteristics for LDK130 (adjustable version)

Symbol	Parameter Test conditions		Min.	Тур.	Max.	Unit	
V _{IN}	Operating input voltage		1.9	-	5.5	V	
V _{ADJ}	\/	I _{OUT} =1 mA, T _J = 25 °C	784	800	816	mV	
	V _{ADJ} accuracy	I _{OUT} = 1 mA, -40 °C < T _J < 125 °C	-3.0		3.0	%	
ΔV_{OUT}	Static line regulation	$V_{OUT} + 1 V \le V_{IN} \le 5.5 V$, $I_{OUT} = 1 mA$	-	0.05	-	%/V	
ΔV_{OUT}	Static load regulation	I _{OUT} = 1 mA to 300 mA	-	0.006	-	%/mA	
		I _{OUT} = 100 mA, V _{OUT} = 2.5 V	-	100	-		
V _{DROP}	Dropout voltage ⁽¹⁾	$I_{OUT} = 300 \text{ mA}, V_{OUT} = 2.5 \text{ V}$ $40 \text{ °C} < T_{J} < 125 \text{ °C}$	-	200	400	mV	
e _N	Output noise voltage	10 Hz to 100 kHz, I _{OUT} = 10 mA	-	130	-	μV _{RMS} /V	
I _{ADJ}	Adjust pin current	-	-		1	μΑ	
SVR	Supply voltage rejection	$V_{IN} = V_{OUTNOM} + 0.5 \text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.1 \text{ V} \text{ freq.} = 120 \text{ Hz to } 10 \text{ kHz}$ $I_{OUT} = 10 \text{ mA}$	-	55		dB	
		I _{OUT} = 0 mA, -40 °C < T _J < 125 °C	-	30	60		
IQ	Quiescent current	I _{OUT} = 300 mA, -40 °C < T _J < 125 °C	-	70	120	μА	
		V _{IN} input current in OFF mode: V _{EN} = GND	-	-	1		
I _{SC}	Short-circuit current	R _L = 0	-	450	-	mA	
V	Enable input logic low	V_{IN} = 1.9 V to 5.5 V, -40 °C < T _J < 125 °C	-	-	0.4	V	
V _{EN}	Enable input logic high	V _{IN} = 1.9 V to 5.5 V, -40 °C < T _J < 125 °C	1.2	-	-	V	
I _{EN}	Enable pin input current	V _{SHDN} = V _{IN}	-		100	nA	
т	Thermal shutdown	-	-	160	-	°C	
T _{SHDN}	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 μ F, V_{EN} to V_{IN} , unless otherwise specified.

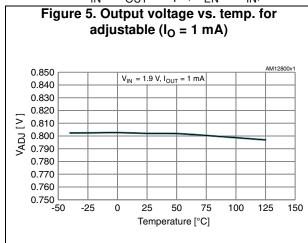
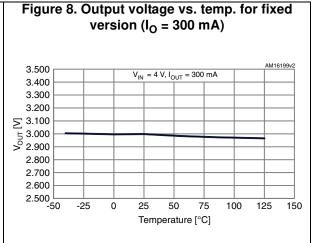


Figure 6. Output voltage vs. temp. for adjustable version (I_O = 300 mA) 0.850 V_{IN} = 1.9 V, I_{OUT} = 300 mA 0.840 0.830 0.820 ∑ 0.810 0.800 ○ 0.800 ○ 0.790 0.780 0.770 0.760 0.750 -50 -25 0 100 125 Temperature [°C]

Figure 7. Output voltage vs. temp. for fixed version $(I_O = 1 \text{ mA})$ 3.500 $V_{IN} = 4 \text{ V}, I_{OUT} = 1 \text{ mA}$ 3.400 3.300 3.200 3.100 3.000 2.900 2.800 2.700 2.600 2.500 -50 50 100 125 150 Temperature [°C]



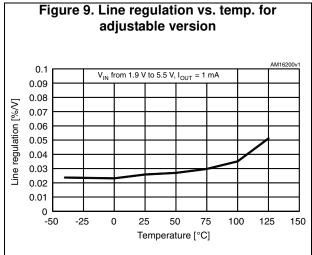


Figure 10. Short-circuit current vs. temp. for adjustable version 600 V_{IN} = 1.9 V 550 500 450 400 350 300 250 200 ^L -50 -25 25 50 75 100 125 150 Temperature [°C]

Figure 11. Load regulation vs. temp. for adjustable version AM16276v1 0.01 V_{IN} = 1.9 V, I_{OUT} from 1 mA to 300 mA Load regulation [%mA] 0.008 0.006 0.004 0.002 -25 50 100 125 150 -50 0 25 75 Temperature [°C]

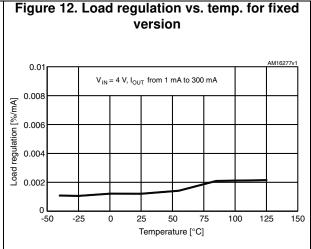
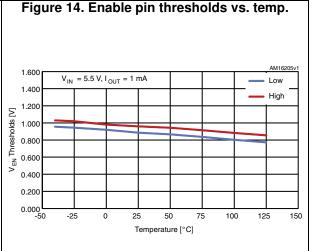


Figure 13. Enable pin thresholds vs. temp. $(V_{IN} = 1.9 V)$ $V_{IN} = 1.9 \text{ V}, I_{OUT} = 1 \text{ mA}$ 0.9 High 0.8 Thresholds 0.7 0.6 0.5 0.4 0.3 0.2 -25 0 50 75 100 125 150 Temperature [°C]



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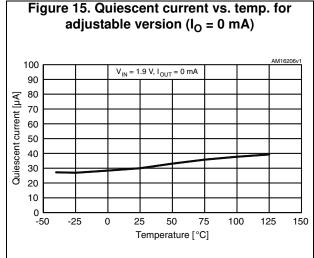
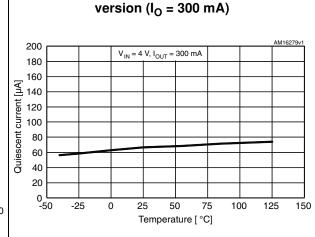
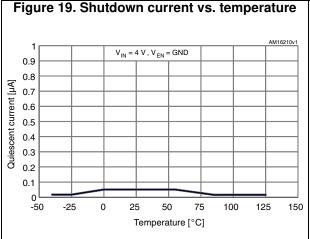
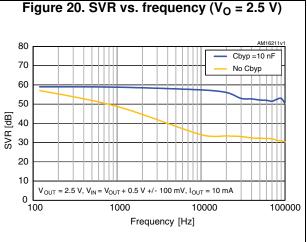


Figure 16. Quiescent current vs. temp. for adjustable version (I_O = 300 mA) 200 $V_{IN} = 1.9 \text{ V}, I_{OUT} = 300 \text{ mA}$ 180 160 Quiescent current [µA] 140 120 100 80 60 40 20 125 -50 -25 150 Temperature [°C]

Figure 17. Quiescent current vs. temp. for fixed | Figure 18. Quiescent current vs. temp. for fixed version $(I_O = 0 \text{ mA})$ 100 V_{IN} = 4 V, I_{OUT} = 0 mA 90 80 Quiescent current [µA] 70 60 50 40 30 20 10 -50 -25 150 Temperature [°C]







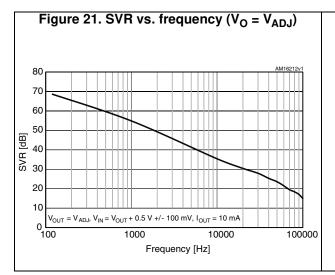


Figure 22. Output noise vs. frequency (V_O = 2.5 V)

V_{IN} = 3.5V, V_{OUT} = 2.5V, C_{IN} = C_{OUT} = 1μF, C_{BYP} = 10nF

10.0000

10.0001

0.0010

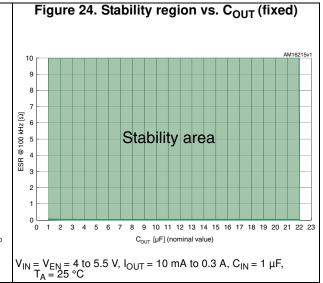
0.0010

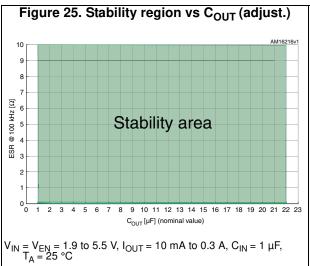
Frequency: f [kHz]

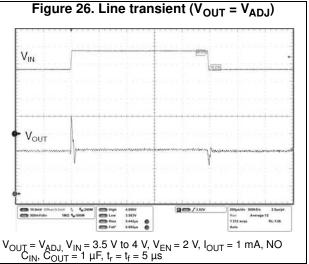
Figure 23. Output noise vs. frequency (V_O = V_{ADJ})

V_N = 1.9V, V_{OUT} = V_{ADJ}, C_N = C_{OUT} = 1 μF

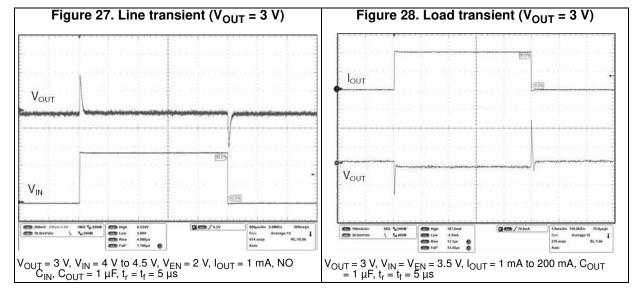
10.0000
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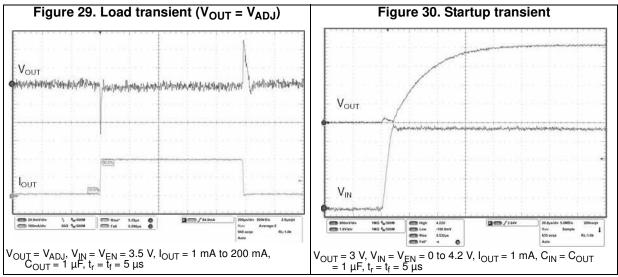


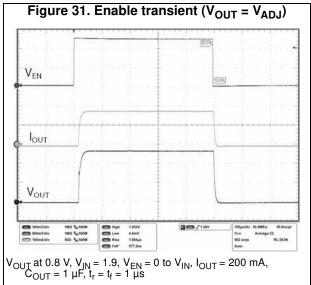


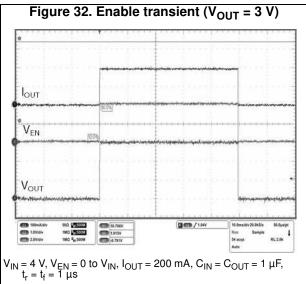


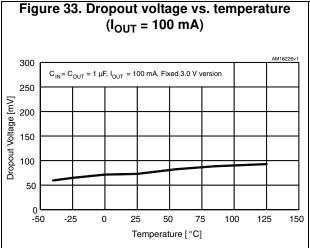
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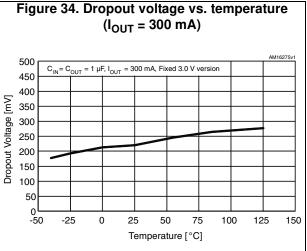












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LDK130 Package information

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

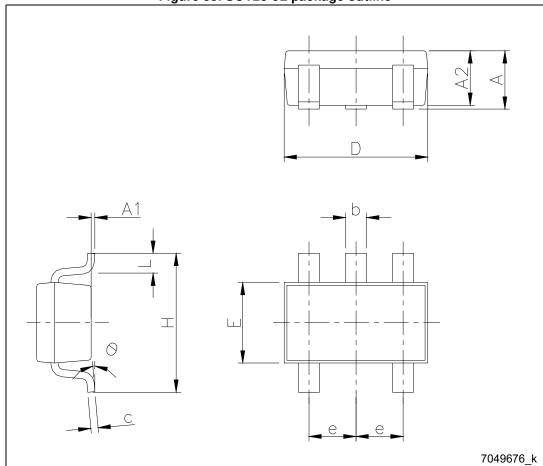


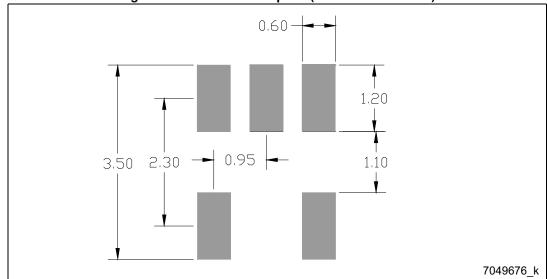
Figure 35. SOT23-5L package outline

Package information LDK130

Table 6. SOT23-5L package mechanical data

Symbol		Dimensions (mm)	
	Min.	Тур.	Max.
А	0.90	-	1.45
A1	0	-	0.15
A2	0.90	-	1.30
b	0.30	-	0.50
С	2.09	-	0.20
D	-	2.95	-
E	-	1.60	-
е	-	0.95	-
Н	-	2.80	-
L	0.30	-	0.60
θ	0	-	8

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



LDK130 Package information

7.2 DFN6 1.2 x 1.3 package information

6x b ььь МСАВ PIN#1 ID 0.10×45° ddd(M) C 6x L ×9 6 4 BOTTOM VIEW // ccc C ⋖ A SEATING PLANE 6x SIDE VIEW cee C D В INDEX AREA (D/2xE/2) aaa C TOP VIEW ☐ aaa C 2x 8442779 A

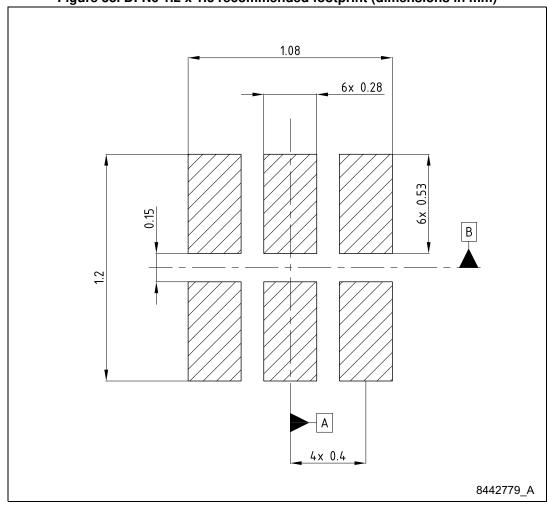
Figure 37. DFN6 1.2 x 1.3 package outline

Package information LDK130

Table 7. DFN6 1.2 x 1.3 package mechanical data

Symbol	Dimensions (mm)			
	Min.	Тур.	Max.	
Α	0.41	0.45	0.50	
A1	0.00	0.02	0.05	
D	-	1.20	-	
E	-	1.30	-	
е	-	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. DFN6 1.2 x 1.3 recommended footprint (dimensions in mm)



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LDK130 Package information

7.3 SOT323-5L package information

SIDE VIEW DIMENSIONS IN mm A2 GAUGE PLANE A[†]1 △ 0.1 C COPLANAR LEADS 0,15 De 1 SEATING PLANE E1/2 **b** Nx (5 LEADS) TOP VIEW 7091413_f

Figure 39. SOT323-5L package outline

Package information LDK130

Table 8. SOT323-5L mechanical data

Symbol		Dimensions (mm)	
Symbol	Min.	Тур.	Max.
А	0.80	-	1.10
A1	0	-	0.10
A2	0.80	0.90	1
b	0.15	-	0.30
С	0.10	-	0.22
D	1.80	2	2.20
E	1.80	2.10	2.40
E1	1.15	1.25	1.35
е	-	0.65	-
e1	-	1.30	-
L	0.26	0.36	0.46
<	0°	-	8°

LDK130 **Package information**

7.4 **Packing information**

7.5 SOT23-5L and SOT323-5L packing information

D Α T Во $\overline{\bigcirc}$ Κo Note: Drawing not in scale

Figure 40. SOT23-5L and SOT323-5L tape and reel outline

Package information LDK130

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

Cumbal	Dimensions (mm)				
Symbol	Min.	Тур.	Max.		
А	-	-	180		
С	12.8	13.0	13.2		
D	20.2	-	-		
N	60	-	-		
Т	-	-	14.4		
Ao	3.13	3.23	3.33		
Во	3.07	3.17	3.27		
Ко	1.27	1.37	1.47		
Po	3.9	4.0	4.1		
Р	3.9	4.0	4.1		

Table 10. SOT323-5L tape and reel mechanical data

Symbol	Dimensions (mm)		
	Min.	Тур.	Max.
А	175	180	185
С	12.8	13	13.2
D	20.2	-	-
N	59.5	60	60.5
Т	-	-	14.4
Ao	-	2.25	-
Во	-	3.17	-
Ко	-	1.2	-
Po	3.9	4.0	4.1
Р	3.9	4.0	4.2

LDK130 Order code

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Table 11. Order code

Packages					
SOT323-5L	SOT23-5L	SOT23-5L ⁽¹⁾	DFN6L	Output voltages	
LDK130C-R	LDK130M-R	-	LDK130PU-R	ADJ	
LDK130C08R	LDK130M08R	-	LDK130PU08R	0.8 V	
LDK130C10R	LDK130M10R	-	LDK130PU10R	1 V	
-	-	LDK130M11RY	-	1.1 V	
LDK130C12R	LDK130M12R	-	LDK130PU12R	1.2 V	
LDK130C15R	LDK130M15R	LDK130M15RY	LDK130PU15R	1.5 V	
LDK130C18R	LDK130M18R	LDK130M18RY	LDK130PU18R	1.8 V	
-	-	LDK130M22RY	-	2.2 V	
-	LDK130M25R	-	LDK130PU25R	2.5 V	
-	-	LDK130M28RY	-	2.8 V	
LDK130C29R	LDK130M29R	-	LDK130PU29R	2.9 V	
-	-	-	LDK130PU30R	3 V	
LDK130C32R	LDK130M32R	-	LDK130PU32R	3.2 V	
LDK130C33R	LDK130M33R	LDK130M33RY	LDK130PU33R	3.3 V	

^{1.} Automotive grade according to AEC-Q100 level 1.

Table 12. Marking

Order code	Package	Output voltage	Marking
LDK130MxxR	SOT23-5L	x.x V	Kxx
LDK130CxxR	SOT323-5L	x.x V	Kxx
LDK130PUxxR	DFN-6L	x.x V	xx
LDK130M-R	SOT23-5L	Adj	KAD
LDK130C-R	SOT323-5L	Adj	KAD
LDK130PU-R	DFN-6L	Adj	AD
LDK130MxxRY	SOT23-5L	x.x V	KxxY

Revision history LDK130

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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. Canceled 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.
07-Sep-2017	4	Updated main title on page 1, Section : Features on page 1, Table 11 on page 25 and Table 12 on page 25 (added "automotive grade level 1" - AEC-Q100 qualified). Updated Features (replaced "max. 120 μA" by "typ. 30 μA". Updated Section : Applications on page 1. Minor modifications throughout document.
26-Oct-2017	5	Updated LDK130M28RY in Table 11: Order codes
17-Jan-2018	6	Updated Figure 22 and Figure 23.
11-Oct-2019	7	Added new part numbers LDK130M11RY and LDK130M22RY in Table 11: Order code.
03-Mar-2020	8	Added new part numbers LDK130C12R, LDK130M12R and LDK130PU12R in <i>Table 11: Order code</i> .

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