LDLN015

150 mA - ultra low noise - high PSRR linear voltage regulator IC

Datasheet - production data

DFN6 (2 x 2 mm)

Features

- Ultra low noise: 6.3 μV_{RMS} from 10 Hz to 100 kHz
- Input voltage from 2.1 to 5.5 V
- Very low quiescent current (35 µA typ. at no load, 70 µA typ. at 150 mA load; 2 µA max. in off mode)
- Output voltage tolerance: ± 1% at 25 °C
- 150 mA guaranteed output current
- Wide range of output voltage from 0.8 V to 3.3 V with 100 mV step
- Logic-controlled electronic shutdown
- Compatible with ceramic capacitor (C_{OUT} = 0.47 µF)
- No bypass capacitor is required
- Internal current and thermal limit
- Package DFN6 (2 x 2 mm)
- Temperature range: - 40 °C to 125 °C

Description

The LDLN015 is an ultra low noise linear regulator which provides 150 mA maximum current from an input voltage ranging from 2.1 V to 5.5 V with a typical dropout voltage of 86 mV. With its 6.3 µ V_{RMS} noise value in a band from 10 Hz to 100 kHz, the LDLN015 provides a very clean output suitable for ultra sensitive loads. It is stable with ceramic capacitors. High PSRR, low quiescent current and very low noise features make it suitable for low power battery powered applications. Power supply rejection is higher than 90 dB at low frequencies and starts to roll off at 10 kHz. The enable logic control function puts the LDLN015 into shutdown mode allowing a total current consumption lower than 1 µA. The device also includes a short-circuit constant current limiting and thermal protection. Typical applications are noise sensitive loads like ADC, VCO in mobile phones, and personal digital assistants (PDAs).

Table 1: Device summary

Order code	Output voltage (V)
LDLN015PU10R	1.0
LDLN015PU12R	1.2
LDLN015PU15R	1.5
LDLN015PU18R	1.8
LDLN015PU25R	2.5
LDLN015PU28R	2.8
LDLN015PU30R	3.0
LDLN015PU33R	3.3

Contents

1 Application diagram

Figure 1: Block diagram

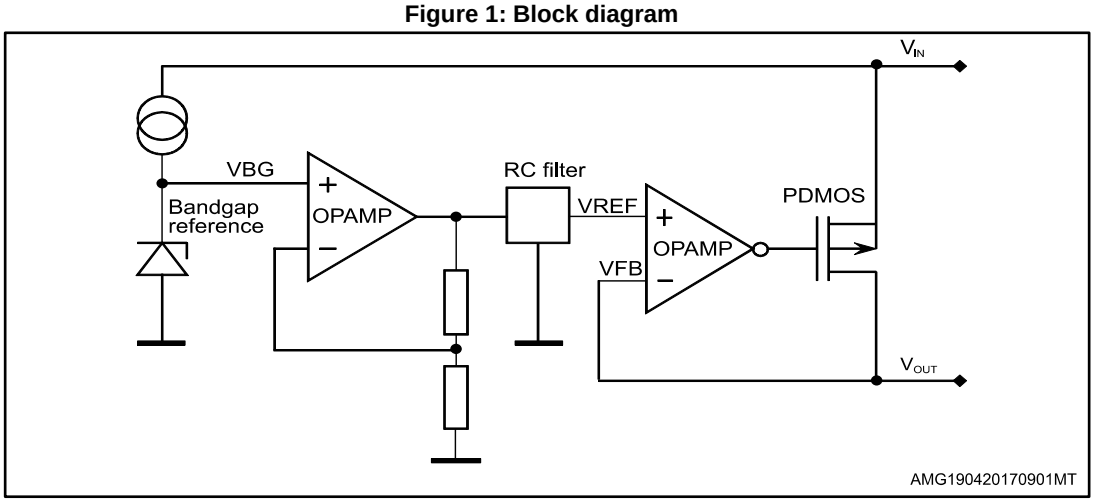
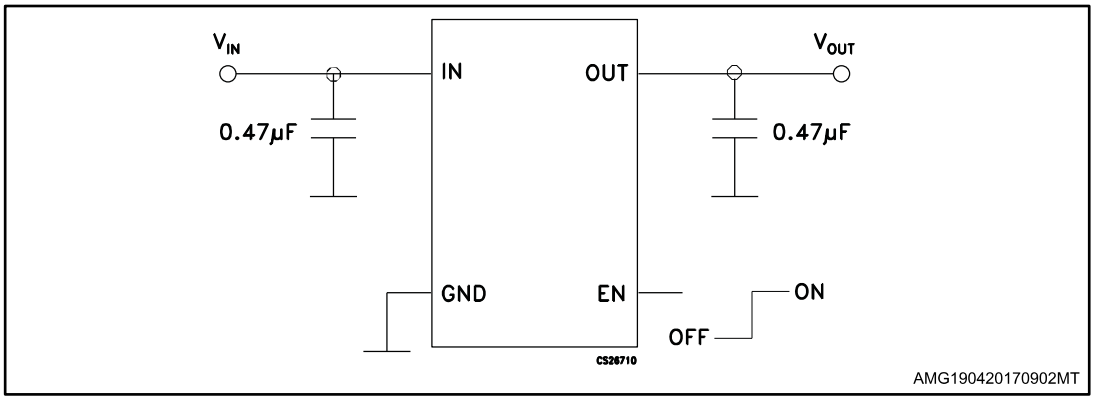


Figure 2: Typical application circuit



2 Pin configuration

Figure 3: Pin connections (top view)

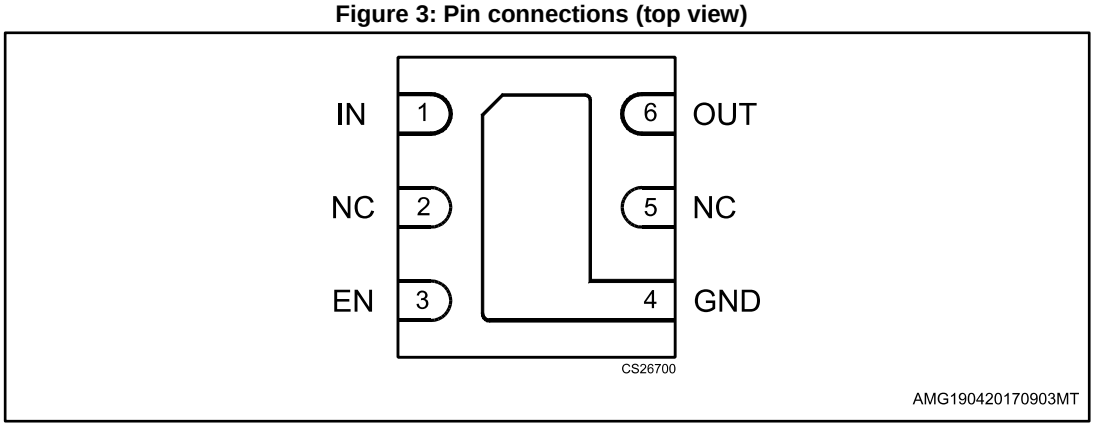


Table 2: Pin description

Pin	Symbol	Name and function
1	IN	Input voltage
2	NC	Not connected
3	EN	Enable input. Set V_{EN} > 0.9 to turn on the device Set V_{EN} < 0.4 to turn off the device
4	GND	Ground
5	NC	Not connected
6	OUT	Output voltage

Exposed pad is electrically connected to GND.

3 Maximum ratings

Table 3: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{IN}	DC input voltage	-0.3 to 7	V
V_{OUT}	DC output voltage	From -0.3 to 4.6	V
V_{EN}	Enable input voltage	From -0.3 to V_{IN} + 0.3	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
ESD	Human body model	±3	kV
	Machine model	±300	V

Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

Table 4: Thermal data

Symbol	Parameter	Value	Unit
R_{thJA}	Thermal resistance junction-ambient	105	°C/W
R_{thJC}	Thermal resistance junction-case	20	°C/W

4 Electrical characteristics

T_J = 25 °C, V_{IN} = $V_{OUT(NOM)}$ + 1 V, C_{IN} = C_{OUT} = 0.47 µF, I_{OUT} = 1 mA, V_{EN} = V_{IN}, unless otherwise specified.

Table 5: Electrical characteristics

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage		2.1		5.5	V
V_{OUT}	V_{OUT} accuracy	I_{OUT} = 1 mA	-1		1	%
		-40 °C < T_J < 125 °C, I_{OUT} = from 1 mA to 150 mA, V_{IN} = $V_{OUT(NOM)}$ + 1 V to 5.5 V	-2		2	
ΔV_{OUT}	Static line regulation	V_{OUT} + 1 V ≤ V_{IN} ≤ 5.5 V, I_{OUT} = 1 mA		0.005		%/V
ΔV_{OUT}	Static load regulation	I_{OUT} = 1 mA to 150 mA		0.001		%/mA
V_{DROP}	Dropout voltage (1)	I_{OUT} = 150 mA, V_{OUT} > 1.9 V -40 °C < T_J < 125 °C		86	180	mV
e_N	Output noise voltage	10 Hz to 100 kHz, I_{OUT} = 0 mA, V_{OUT} = 1.0 V		6.3		µV_{RMS}
		10 Hz to 100 kHz, I_{OUT} = 150 mA, V_{OUT} = 1.0 V		9.9		
SVR	Supply voltage rejection V_{OUT} = 1.0 V	V_{IN} = V_{OUTNOM} + 1 V +/-V_{RIPPLE} V_{RIPPLE} = 0.5 V Freq. = 1 kHz I_{OUT} = 10 mA		92		dB
		V_{IN} = V_{OUTNOM} + 1 V +/-V_{RIPPLE} V_{RIPPLE} = 0.5 V Freq. = 10 kHz I_{OUT} = 10 mA		89		
		V_{IN} = V_{OUTNOM} + 1 V+/-V_{RIPPLE} V_{RIPPLE} = 0.5 V Freq. = 100 kHz I_{OUT} = 1 mA		50		
I_Q	Quiescent current	I_{OUT} = 0 mA, -40 °C < T_J < 125 °C		35	60	µA
		I_{OUT} = 150 mA, -40 °C < T_J < 125 °C		70	120	
		V_{IN} input current in OFF mode V_{EN} = GND		0.002	2	
I_{SC}	Short-circuit current	R_L = 0 V_{IN} = 2.0 V	300			mA

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_{EN}	Enable input logic low	V_{IN} = 2.1 V to 5.5 V, -40 °C < T_J < 125 °C			0.4	V
	Enable input logic high	V_{IN} = 2.1 V to 5.5 V, -40 °C < T_J < 125 °C	0.9			
I_{EN}	Enable pin input current	V_{EN} = 5.5 V		0.1	100	nA
T_{ON}	Turn-on time (2)			110		µs
T_{SHDN}	Thermal shutdown			166		°C
	Hysteresis			10		
C_{OUT}	Output capacitor	Capacitance (see *Figure 15: "Stability area"*)	0.33		4.7	µF

Notes:

(1)Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value. This specification does not apply for output voltages below 2 V.

(2)Turn-on time is time measured between the enable input just exceeding V_{EN} high value and the output voltage just reaching 95% of its nominal value.

Note:

- For $V_{OUT(NOM)}$ < 1.0 V, V_{IN} = 2 V
- All transient values are guaranteed by design, not production tested

5 Typical performance characteristics

Figure 4: Output voltage vs temperature

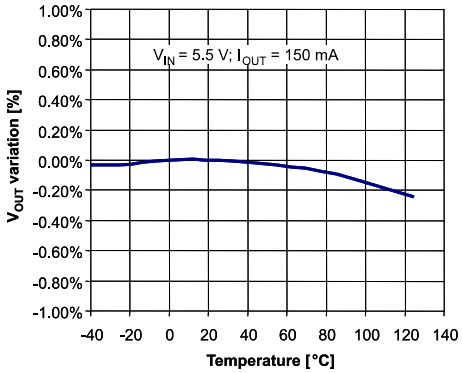


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Figure 5: Output voltage vs input voltage V_{OUT} = 1 V

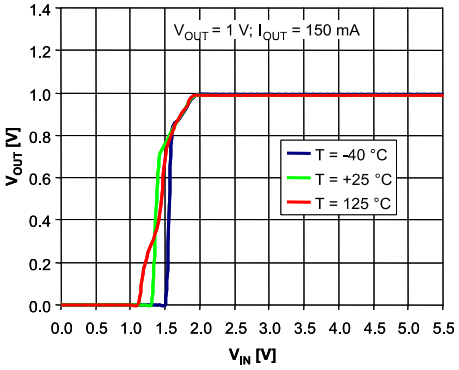

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Figure 6: Output voltage vs input voltage V_{OUT} = 3.3 V

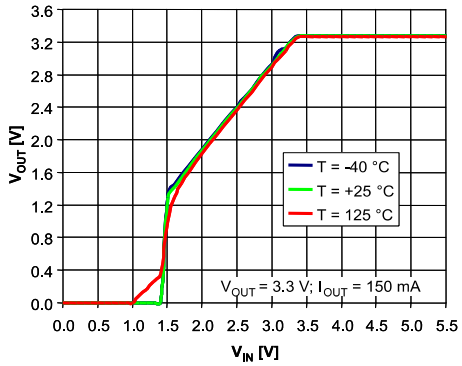

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Figure 7: Dropout voltage vs temperature

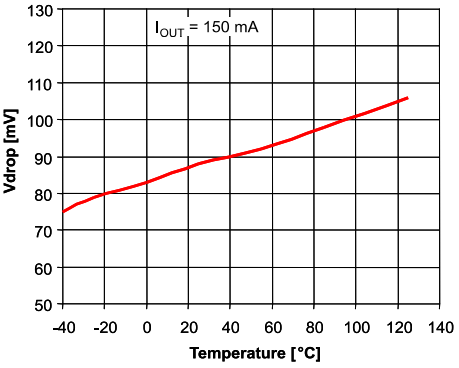

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Figure 8: Dropout voltage vs I_{OUT}

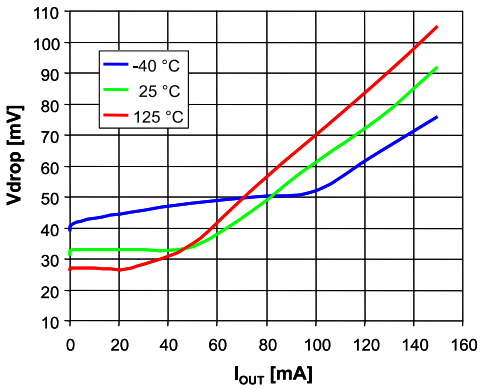

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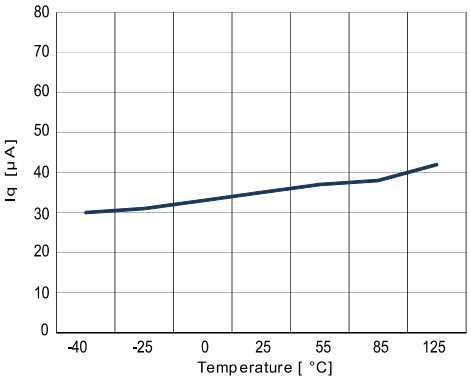
Figure 9: Quiescent current vs temperature



V_{IN} = 4.3 V, V_{OUT} = 3.3 V, I_{OUT} = 0 mA, V_{EN} = V_{IN}

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Figure 10: Quiescent current vs I_{OUT}

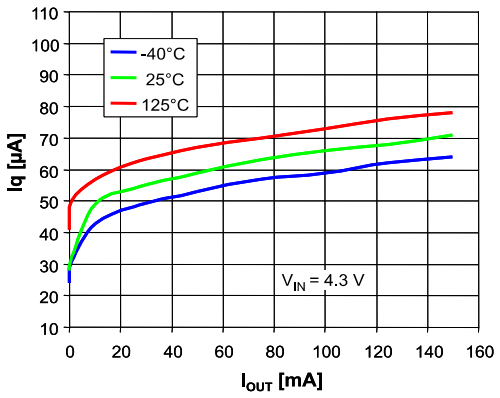

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Figure 11: Quiescent current vs V_{IN}

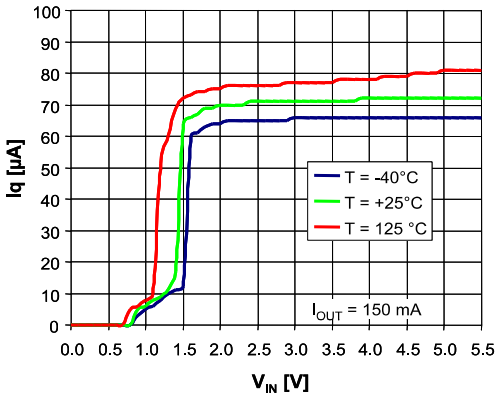

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Figure 12: Supply voltage rejection vs frequency

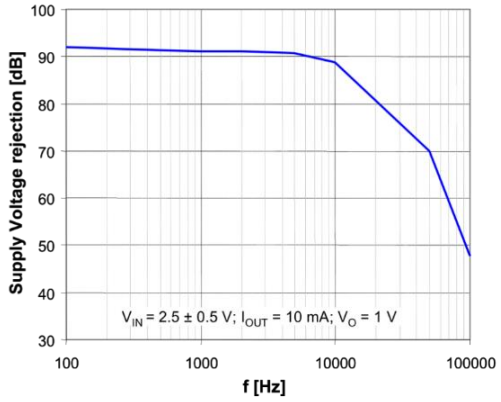

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Figure 13: Supply voltage rejection vs I_{OUT}

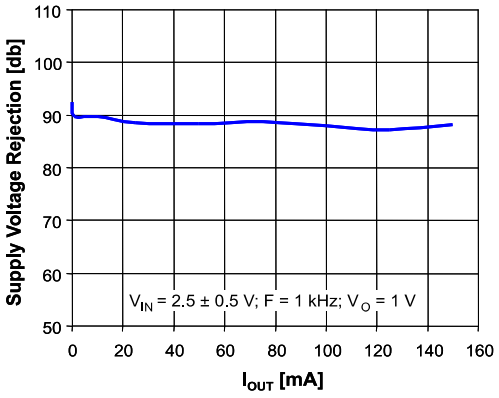

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Figure 14: Noise spectral density

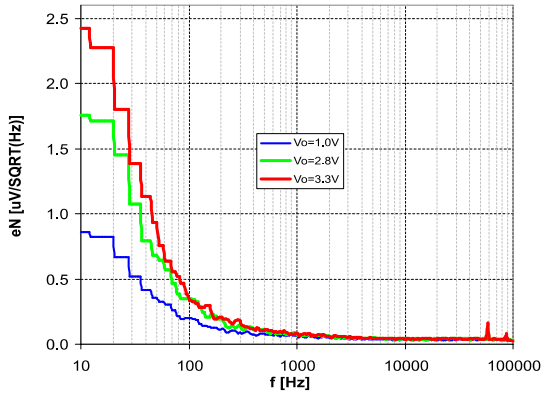

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Figure 15: Stability area

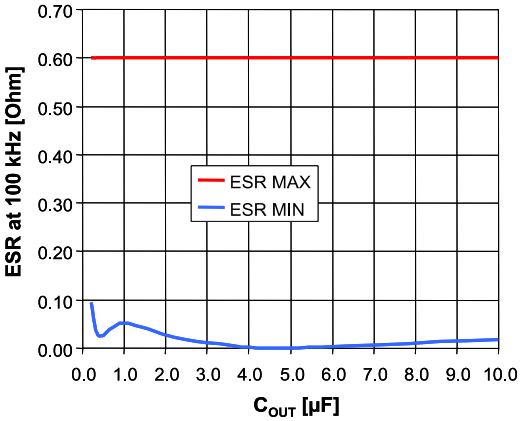

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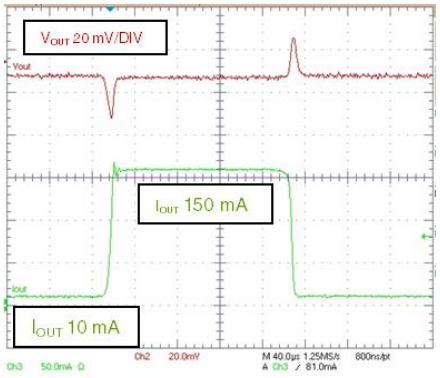
Figure 16: Load transient



I_{OUT} = from 10 to 150 mA; t_{rise} = t_{fall} = 5 µs

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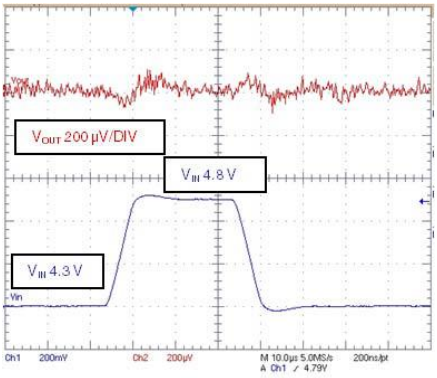
Figure 17: Line transient at I_{OUT} = 1 mA



V_{IN} = from 4.3 to 4.8 V; I_{OUT} = 1 mA; t_{rise} = t_{fall} = 5 µs

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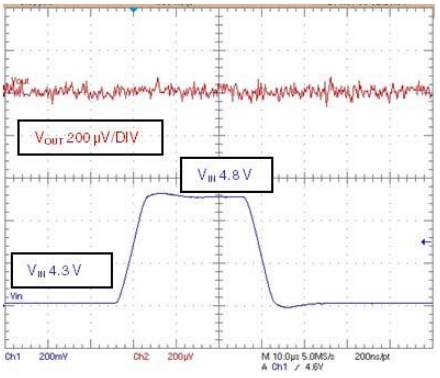
Figure 18: Line transient at I_{OUT} = 150 mA



V_{IN} = from 4.3 to 4.8 V; I_{OUT} = 150 mA; t_{rise} = t_{fall} = 5 µs

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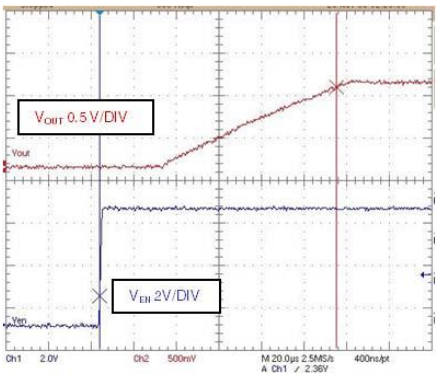
Figure 19: Turn-on time at I_{OUT} = 1 mA; V_{OUT} = 1 V



V_{IN} = 2 V; V_O = 1 V; I_{OUT} = 1 mA

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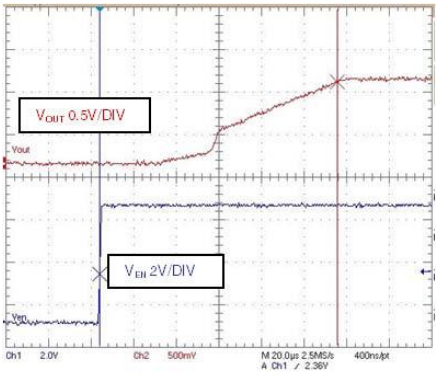
Figure 20: Turn-on time at I_{OUT} = 150 mA, V_{OUT} = 1 V



V_{IN} = 2 V; V_O = 1 V; I_{OUT} = 150 mA

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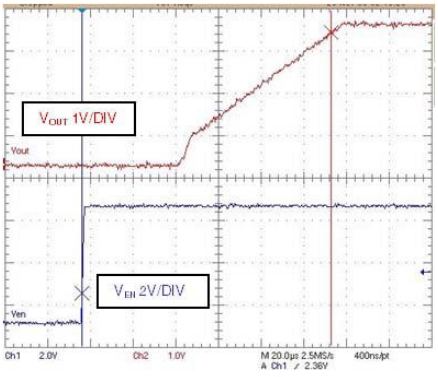
Figure 21: Turn-on time at I_{OUT} = 1 mA; V_{OUT} = 3.3 V



V_{IN} = 4.3 V; V_O = 3.3 V; I_{OUT} = 1 mA

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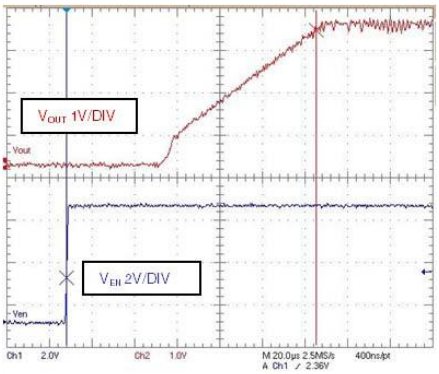
Figure 22: Turn-on time at I_{OUT}= 150 mA, V_{OUT} = 3.3 V



V_{IN} = 4.3 V; V_O = 3.3 V; I_{OUT} = 150 mA

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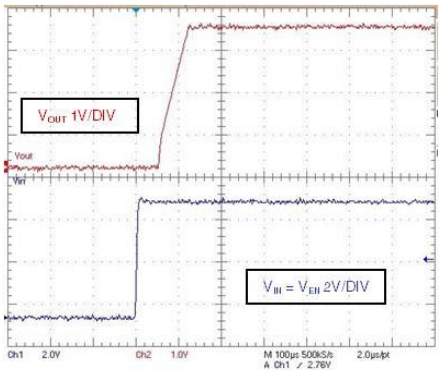
Figure 23: Startup transient



V_O = 3.3 V; I_{OUT} = 150 mA

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6 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.

6.1 DFN6 (2 x 2 mm) package information

Figure 24: DFN6 (2 x 2 mm) package outline

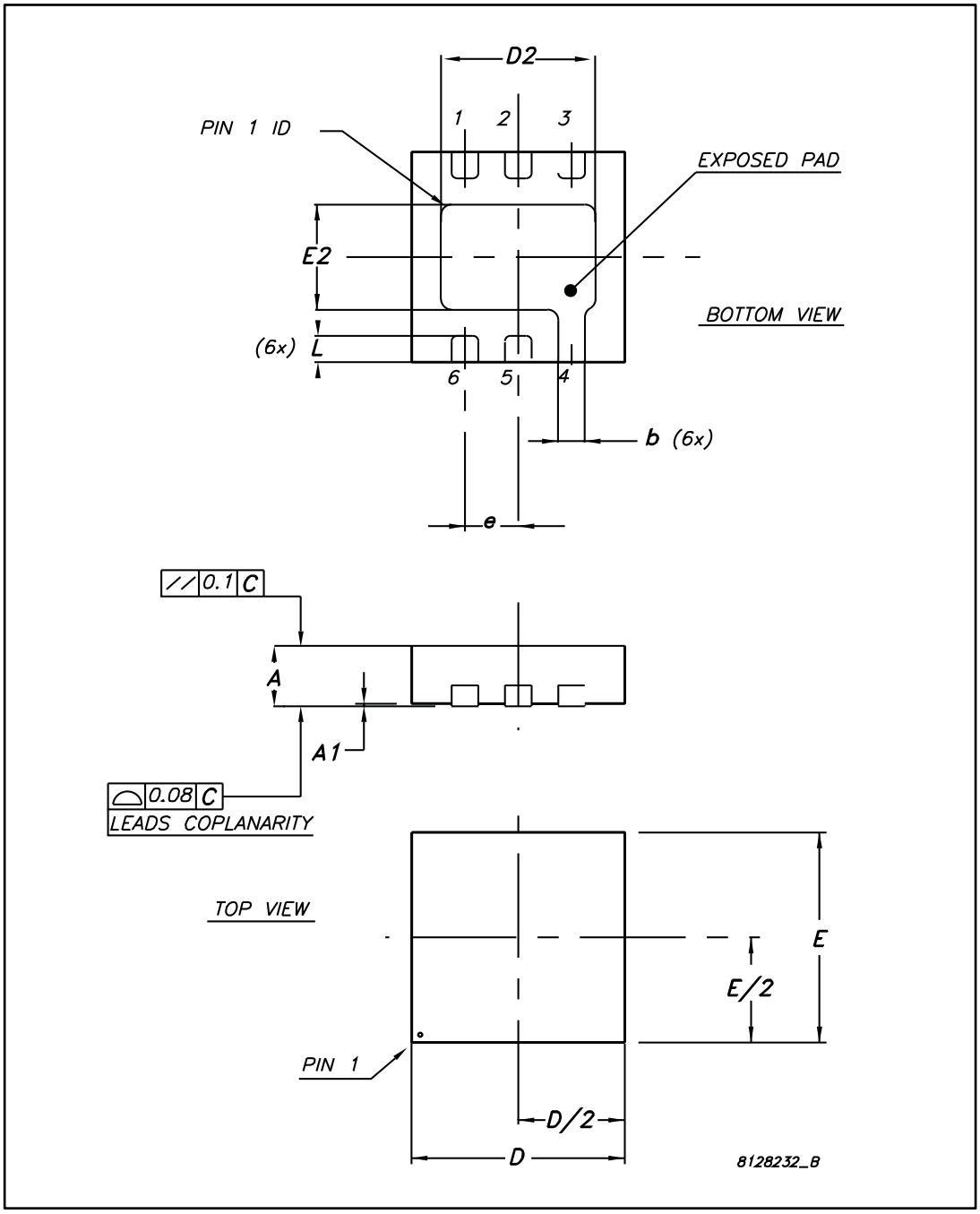
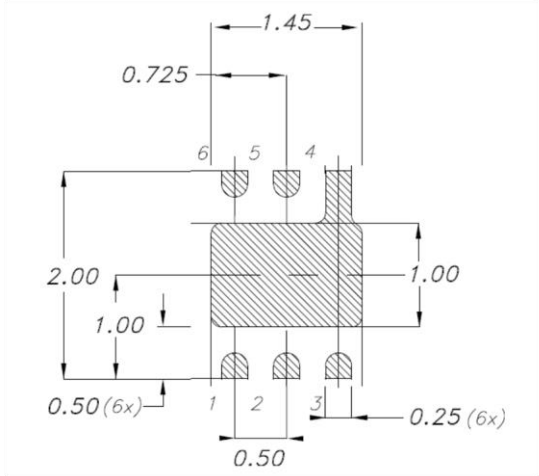


Table 6: DFN6 (2 x 2 mm) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.51	0.55	0.60
A1	0	0.02	0.05
b	0.18	0.25	0.30
D		2.00	
D2	1.30	1.45	1.55
E		2.00	
E2	0.85	1.00	1.10
e		0.50	
L	0.15	0.25	0.35

Figure 25: DFN6 (2 x 2 mm) recommended footprint



6.2 DFN6 (2 x 2 mm) packing information

Figure 26: DFN6 (2 x 2 mm) reel outline

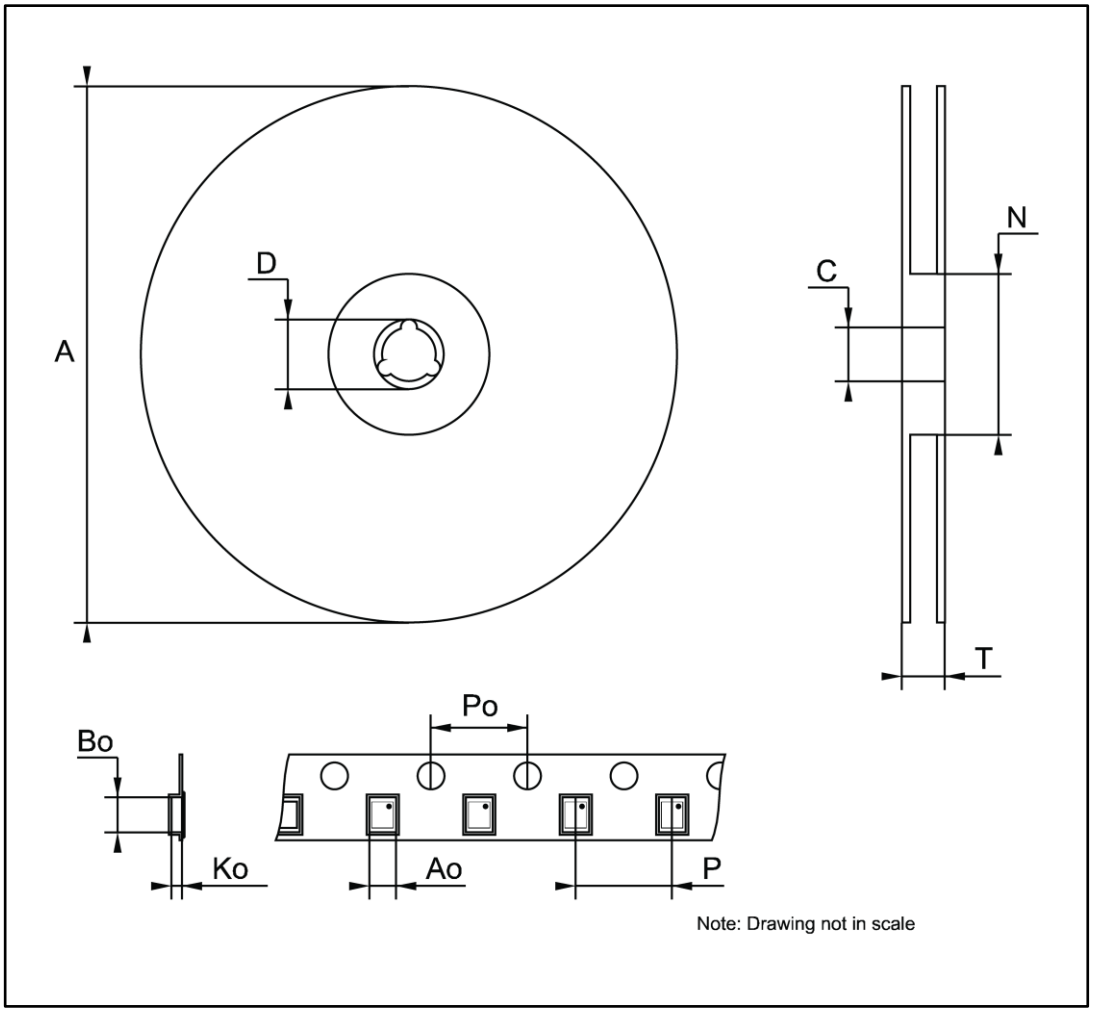


Table 7: DFN6 (2 x 2 mm) tape and reel mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			180
C	12.8		13.2
D	20.2		
N	60		
T			14.4
A0		2.4	
B0		2.4	
K0		1.3	
P0		4	
P		4	

7 Revision history

Table 8: Document revision history

Date	Revision	Changes
31-Jan-2012	1	Initial release.
15-Jan-2014	2	Changed the LDLN015xx to LDLN015. Updated the Description in cover page. Updated Table 1: Device summary, Section 5: Typical performance characteristics and Section 6: Package information. Added Section 6.2: DFN6 (2 x 2 mm) packing information. Minor text changes.
14-Jan-2015	3	Updated the features in cover page. Updated Table 5: Electrical characteristics and Figure 9: Quiescent current vs. temperature. Minor text changes.
26-Oct-2015	4	Modified Section 6: Package information. Minor text changes.
18-May-2017	5	Updated *Section 6.1: "DFN6 (2 x 2 mm) package information"*. Minor text changes.

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