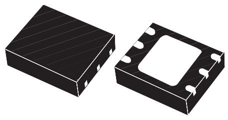
LDLN015xx

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

Preliminary data

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 (17 µA typ. at no load, 54 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



DFN6 (2 x 2 mm)

Description

The LDLN015xx 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 μV_{RMS} noise value in a band from 10 Hz to 100 kHz, the LDLN015xx 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 LDLN015xx 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

Part numbers	Order codes	Output voltages
LDLN015XX10	LDLN015PU10R	1.0 V
LDLN015XX12	LDLN015PU12R	1.2 V
LDLN015XX15	LDLN015PU15R	1.5 V
LDLN015XX18	LDLN015PU18R	1.8 V
LDLN015XX28	LDLN015PU28R	2.8 V
LDLN015XX33	LDLN015PU33R	3.3 V

This is preliminary information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

Contents

1 Application diagram

Figure 1. Block diagram

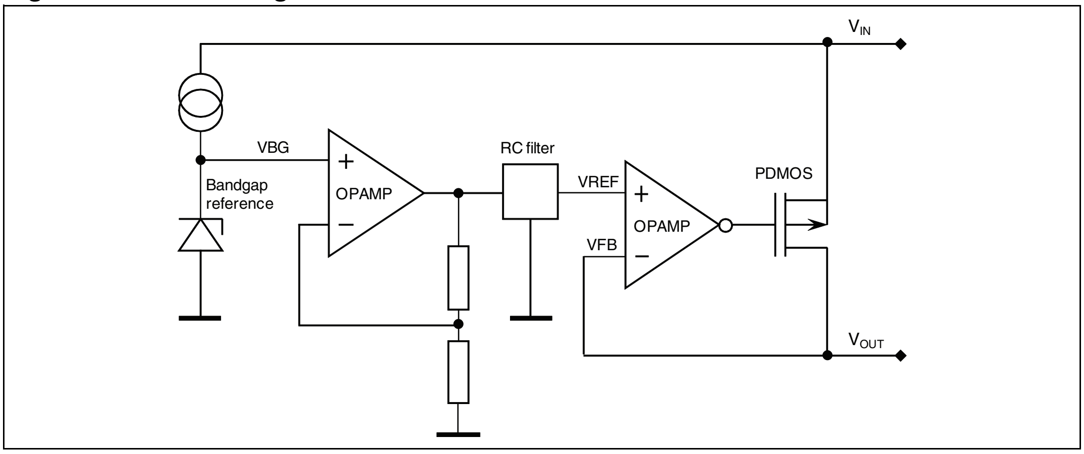
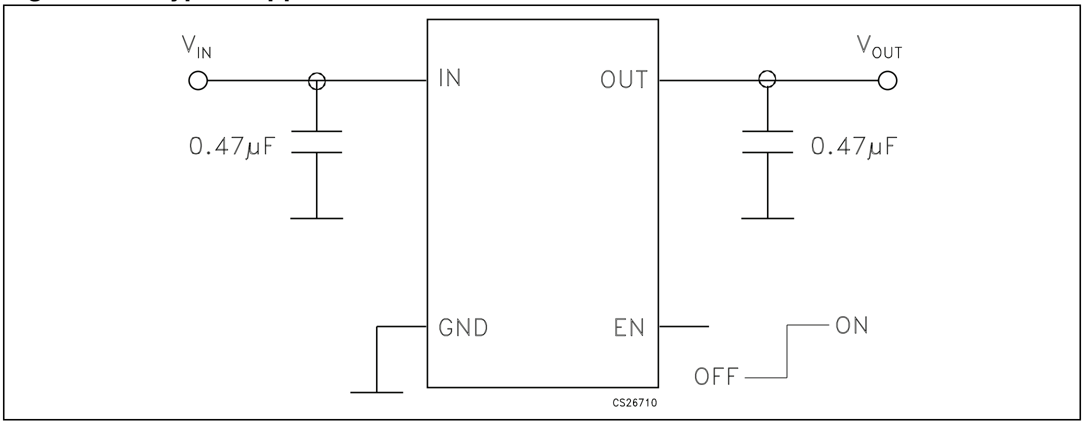


Figure 2. Typical application circuit



2 Pin configuration

Figure 3. Pin connections (top view)

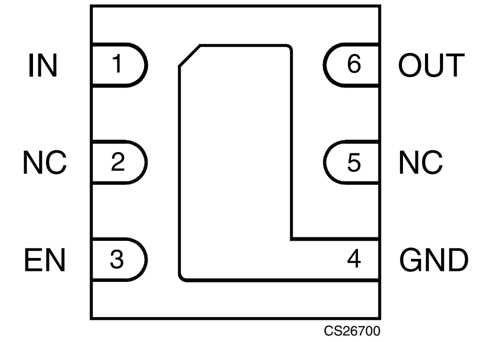


Table 2. Pin description

Pin n°	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

Note: 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

Note: 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 [(1)] [(2)]

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage		2.1		5.5	V
V_{OUT}	V_{OUT} accuracy	I_{OUT} =1mA	-1		1	%
		-40°C<T_J<125°C, I_{OUT}=from 1mA to 150mA, $V_{IN}=V_{OUT(NOM)}$ + 1V to 5.5	-2		2	
ΔV_{OUT}	Static line regulation	V_{OUT} +1V ≤V_{IN} ≤5.5V, I_{OUT} = 1mA		0.005		%/V
ΔV_{OUT}	Static load regulation	I_{OUT} = 1mA to 150mA		0.001		%/mA
V_{DROP}	Dropout voltage [(3)]	I_{OUT} = 150mA, V_{OUT} > 1.9V -40°C<T_J<125°C		86	180	mV
e_N	Output noise voltage	10Hz to 100kHz, I_{OUT} = 0mA, V_{OUT} =1.0V		6.3		μV_{RMS}
		10Hz to 100kHz, I_{OUT} = 150mA, V_{OUT} =1.0V		9.9		
SVR	Supply voltage rejection V_{OUT} =1.0V	$V_{IN} = V_{OUTNOM}$+1V+/-V_{RIPPLE} V_{RIPPLE} = 0.5V Freq.=1kHz I_{OUT} = 10mA		92		dB
		$V_{IN} = V_{OUTNOM}$+1V+/-V_{RIPPLE} V_{RIPPLE} = 0.5V Freq.=10kHz I_{OUT} = 10mA		89		
		$V_{IN} = V_{OUTNOM}$+1V+/-V_{RIPPLE} V_{RIPPLE} = 0.5V Freq.=100kHz I_{OUT} = 1mA		50		
I_Q	Quiescent current	I_{OUT}=0mA		17		µA
		I_{OUT}=0mA, -40°C<T_J<125°C			60	
		I_{OUT}=150mA		54		
		I_{OUT}=150mA, -40°C<T_J<125°C			120	
		V_{IN} input current in OFF mode V_{EN}=GND		0.002	2	
I_{SC}	Short-circuit current	R_L=0; V_{IN}=2.0V	300			mA
V_{EN}	Enable input logic low	V_{IN} = 2.1V to 5.5V, -40°C<T_J <125°C			0.4	V
	Enable input logic high	V_{IN} = 2.1V to 5.5V, -40°C<T_J <125°C	0.9			
I_{EN}	Enable pin input current	V_{EN}=5.5V		0.1	100	nA
T_{ON}	Turn-on time [(4)]			110		µs

Table 5. Electrical characteristics (1) (2) (continued)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
T_{SHDN}	Thermal shutdown			166		°C
	Hysteresis			10		
C_{OUT}	Output capacitor	Capacitance (see *Figure 15*)	0.33		4.7	µF

1. For $V_{OUT(NOM)} < 1.0$ V $V_{IN} = 2$ V.
2. All transient values are guaranteed by design, not production tested.
3. 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.
4. 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.

5 Typical performance characteristics

Figure 4. Output voltage vs. temperature

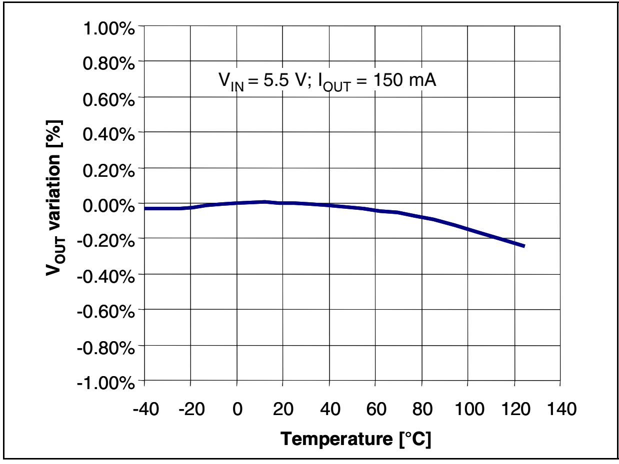


Figure 5. Output voltage vs. input voltage

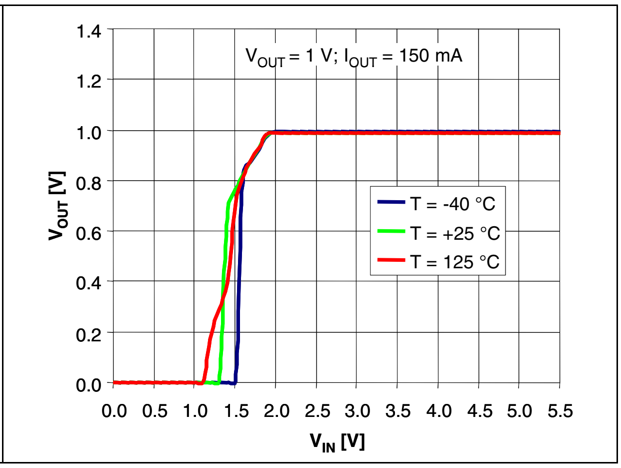


Figure 6. Output voltage vs. input voltage

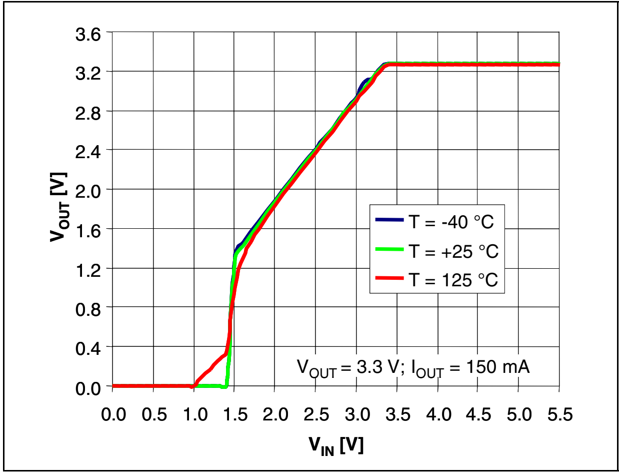


Figure 7. Dropout voltage vs. temperature

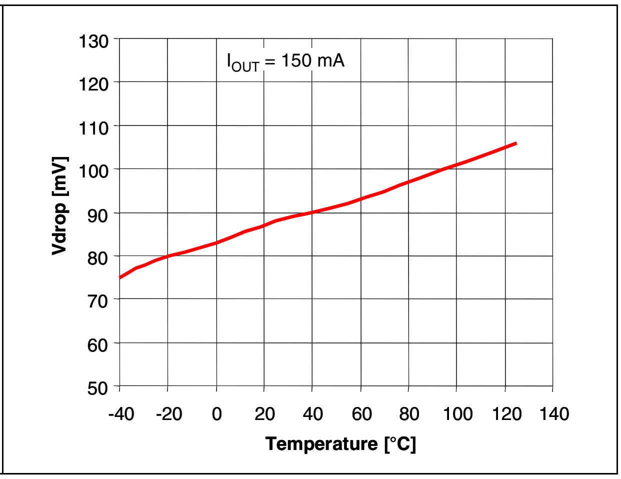


Figure 8. Dropout voltage vs. I_{OUT}

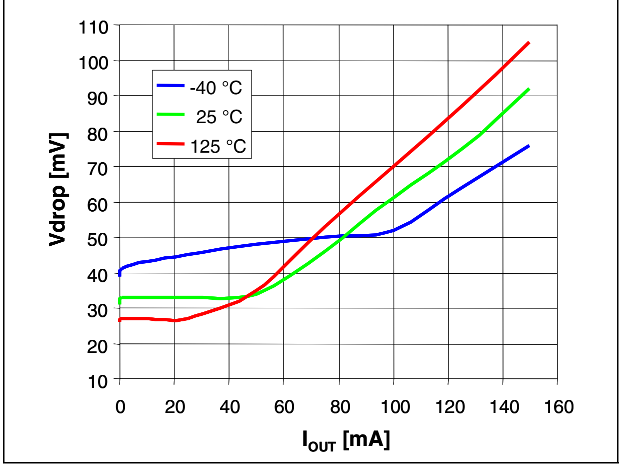


Figure 9. Quiescent current vs. temperature

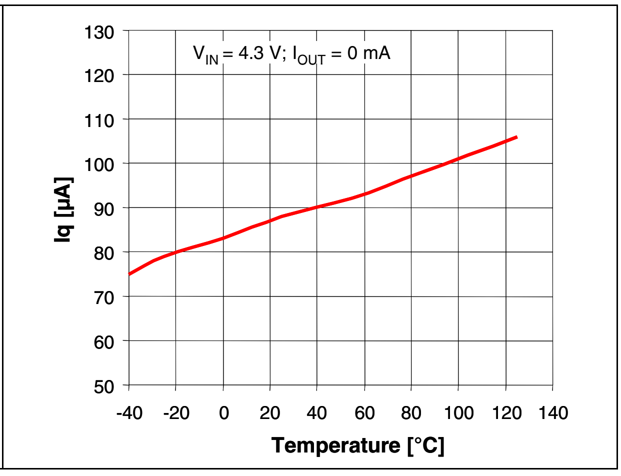


Figure 10. Quiescent current vs. I_{OUT}

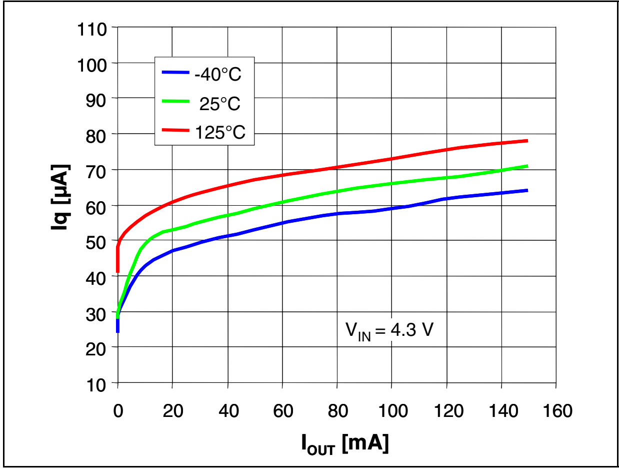


Figure 11. Quiescent current vs. V_{IN}

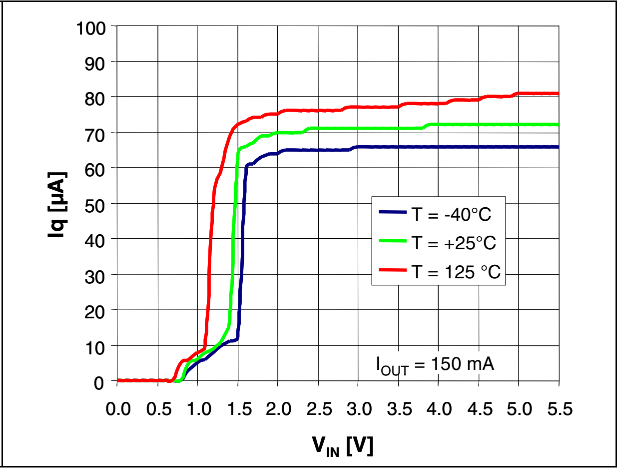


Figure 12. Supply voltage rejection vs. frequency

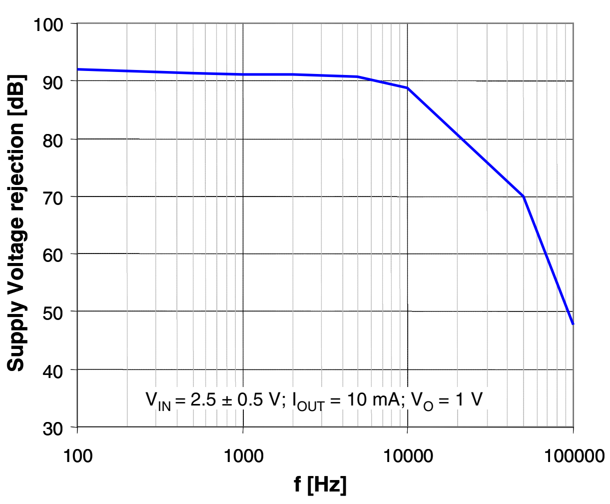


Figure 13. Supply voltage rejection vs. I_{OUT}

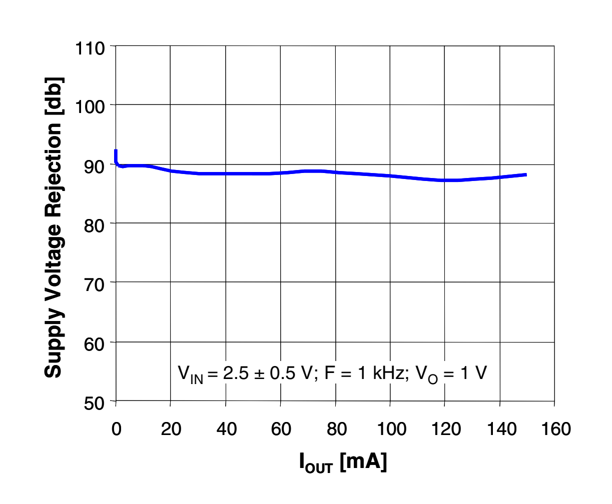


Figure 14. Noise spectral density

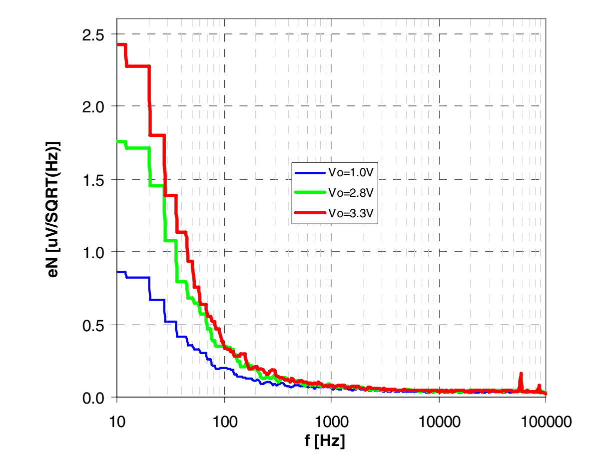


Figure 15. Stability area

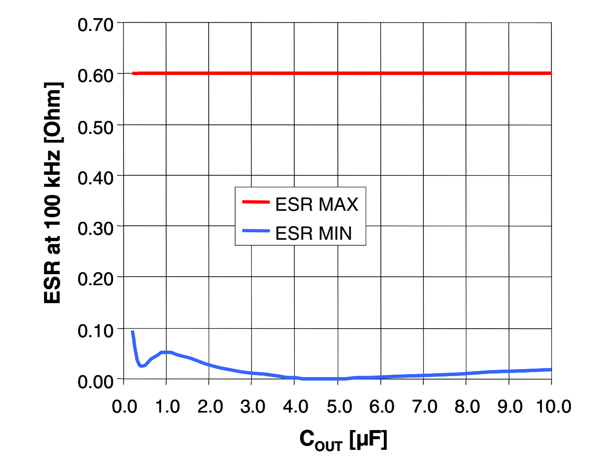
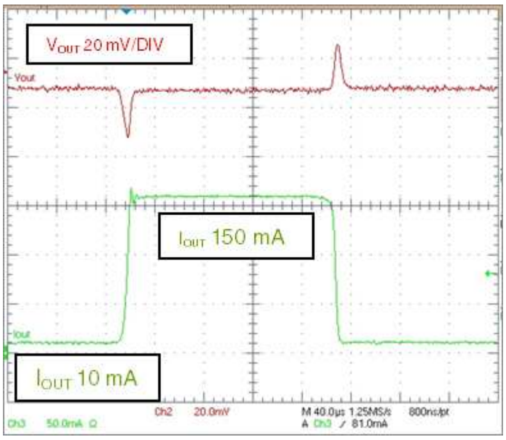
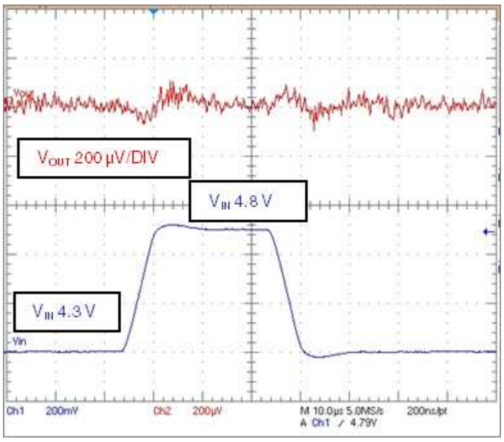


Figure 16. Load transient



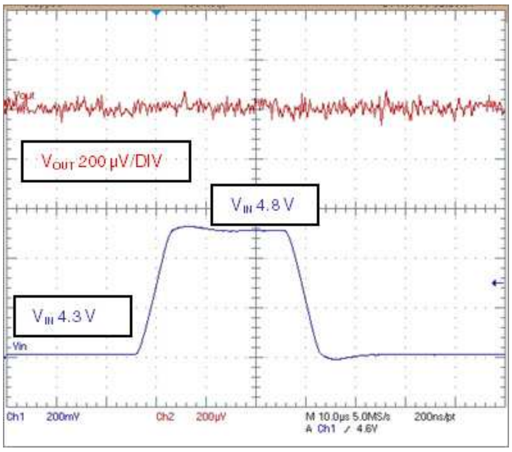
I_{OUT} = from 10 to 150 mA; $t_{rise} = t_{fall}$ = 5 µs

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



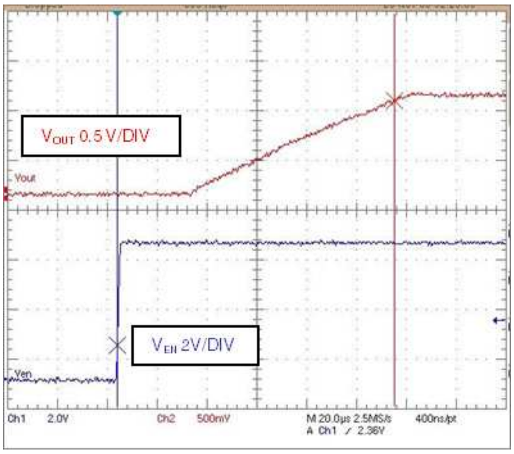
V_{IN} = from 4.3 to 4.8 V; I_{OUT} = 1 mA; $t_{rise} = t_{fall}$ = 5 µs

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



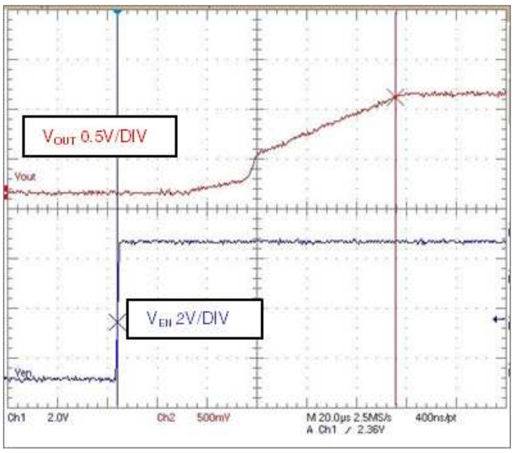
V_{IN} = from 4.3 to 4.8 V; I_{OUT} = 150 mA; $t_{rise} = t_{fall}$ = 5 µs

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



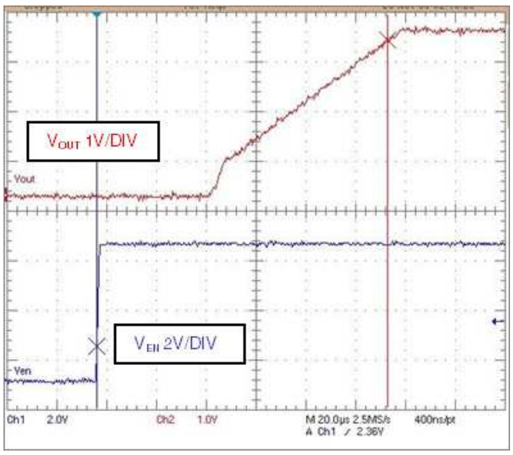
V_{IN} = 2 V; V_O = 1 V; I_{OUT} = 1 mA

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



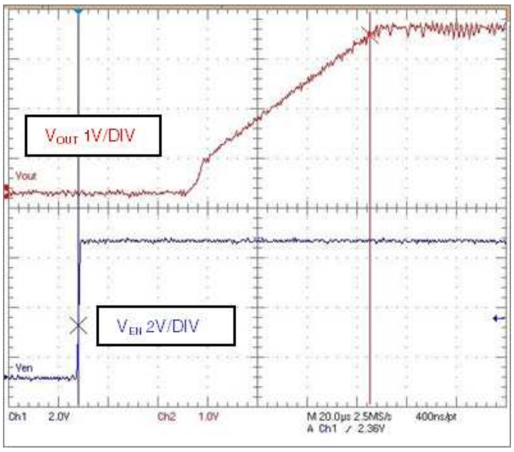
V_{IN} = 2 V; V_O = 1 V; I_{OUT} = 150 mA

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



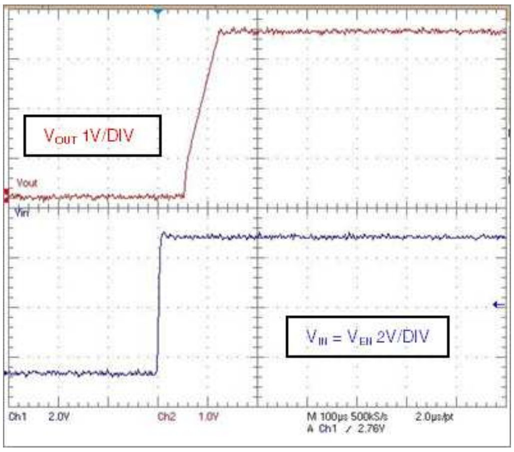
V_{IN} = 4.3 V; V_O = 3.3 V; I_{OUT} = 1 mA

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

Figure 23. Startup transient



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

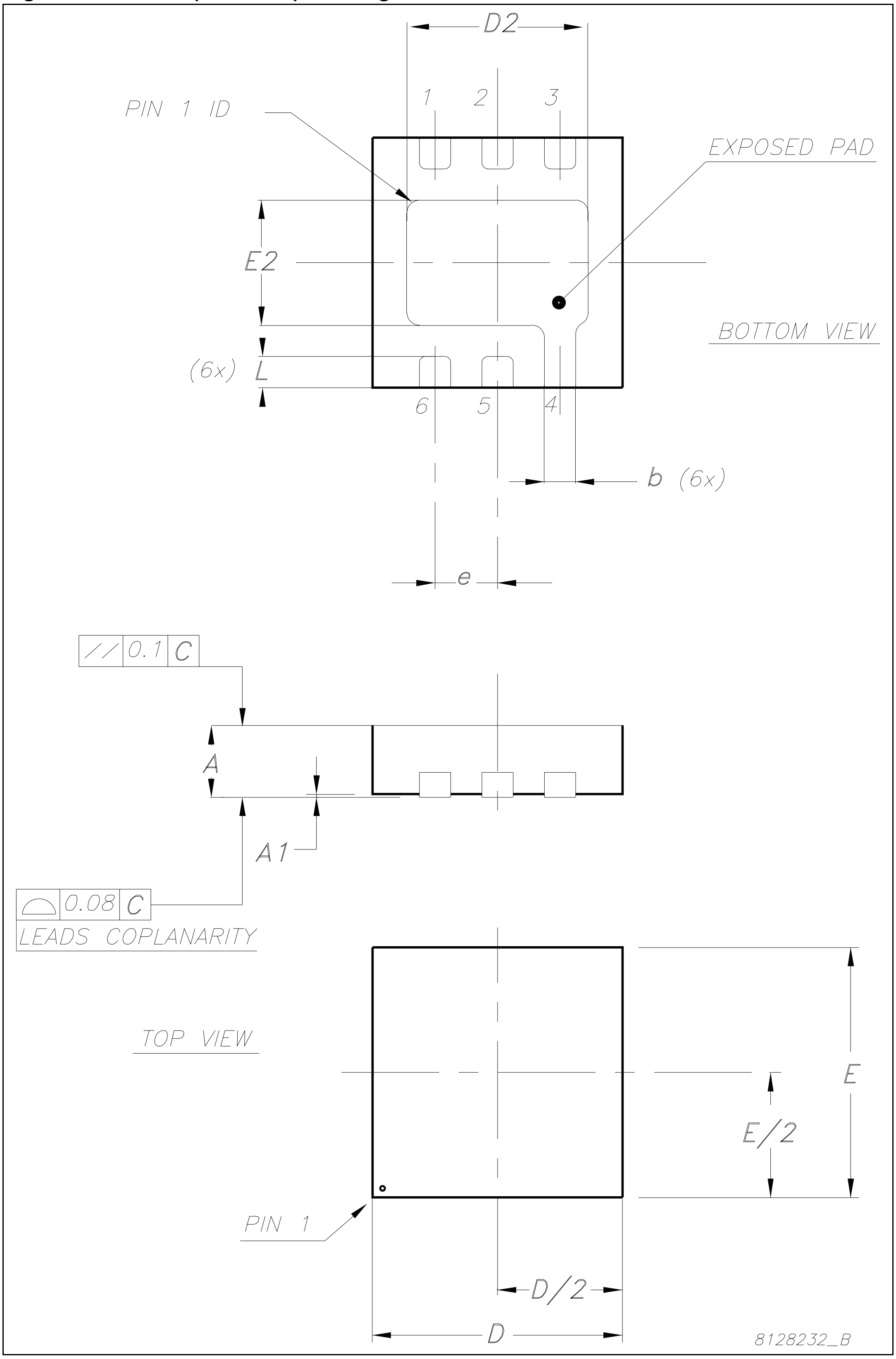
6 Package mechanical data

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.

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

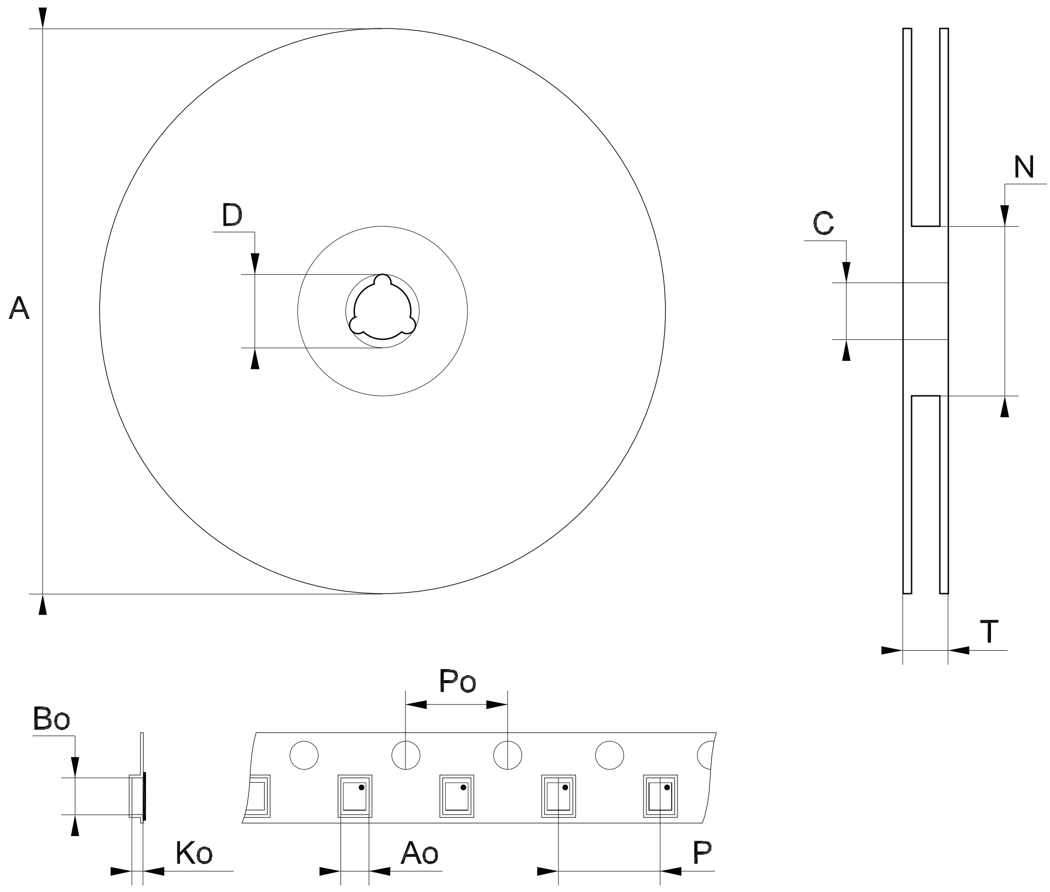
Dim.	mm.		
	Min.	Typ.	Max.
A	0.51	0.55	0.60
A1	0	0.02	0.05
b	0.18	0.25	0.30
D		2.00	
D2	1.30	1.45	1.55
E		2.00	
E2	0.85	1.00	1.10
e		0.50	
L	0.15	0.25	0.35

Figure 24. DFN6 (2 x 2 mm) drawing dimensions



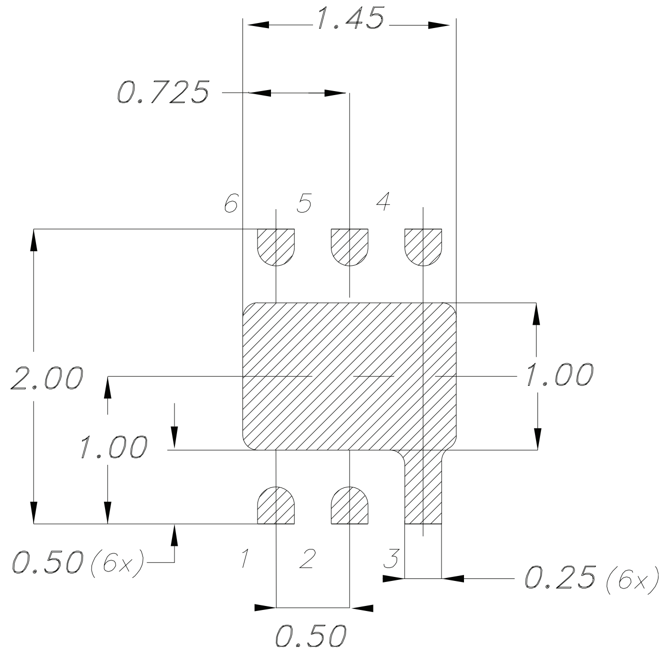
Tape & reel QFNxx/DFNxx (2x2 mm) mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			180			7.087
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			14.4			0.567
Ao		2.3			0.091	
Bo		2.3			0.091	
Ko		1.0			0.039	
Po		4			0.157	
P		8			0.315	



Note: Drawing not in scale

Figure 25. DFN6 (2 x 2) footprint recommended data (dimensions in mm.)



7 Revision history

Table 7. Document revision history

Date	Revision	Changes
31-Jan-2012	1	Initial release.