

300 mA ultra low-noise LDO with Power Good and soft-start

TSOT23-5L

Features

- Ultra-low output noise: 7.5 μV_{RMS}
- Operating input voltage range: 1.6 V to 5.5 V
- · Undervoltage lockout
- Output current up to 300 mA
- Very low quiescent current:16 μA at no-load
- · Controlled Iq in dropout condition
- Very low dropout voltage: 100 mV at 200 mA, 150 mV at 300 mA
- Very high PSRR: 80 dB @ 100 Hz, 60 dB @ 100 kHz
- Output voltage accuracy: 2% across line, load and temperature
- Output voltage versions: from 1 V to 5 V, with 50 mV step
- · Logic-controlled electronic shutdown
- Power Good
- · Output discharge feature
- Internal soft-start to limit the in-rush current
- Overcurrent and thermal protections
- Temperature range: from -40 °C to +125 °C
- Package: TSOT23-5L

Maturity status link LDLN030

Device summary			
Order code LDLN030G33R			
Package TSOT23-5L			
Output voltage	ge 3.3 V		
Marking	KN33		
Packing	Tape and reel		

Applications

- Smartphones/tablets
- Image sensors
- Instrumentation
- VCO and RF modules
- HDD and SSD
- Portable and other battery powered devices

Description

The LDLN030 is a 300 mA very low-dropout voltage regulator, able to work with an input voltage ranging from 1.6 V to 5.5 V.

The typical dropout voltage at 300 mA load is 150 mV.

The very low quiescent current, which is just 16 μ A at no load, extends battery-life of applications requiring very long standby time.

Thanks to its ultra low-noise value and high PSRR the device provides a very clean output, suitable for ultra-sensitive loads. It is stable with ceramic capacitors.

The enable logic control function puts the LDLN030 into shutdown mode allowing a total current consumption lower than 1 μ A.

The device also includes short-circuit constant current limiting, undervoltage lockout, soft-start, Power Good and thermal protection.

Typical applications are noise sensitive loads such as ADC, VCO in mobile phones and tablets, wireless lan devices. The LDLN030 is designed to keep the quiescent



current under control and at a low value also during dropout operation, helping to extend even more the operating time of battery-powered devices.

DS12443 - Rev 1 page 2/21



1 Diagram

V_{IN}
Bias generator

Enable

Power Good

PG

Figure 2. Block diagram

DS12443 - Rev 1 page 3/21



Pin configuration

Figure 3. Pin connection (top view)

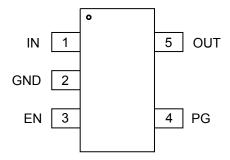


Table 1. Pin description

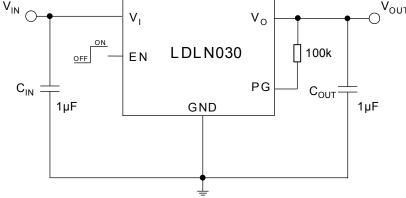
Symbol	TSOT23-5L	Description
V _{IN}	1	LDO supply voltage
V _{OUT}	5	LDO output voltage
GND	2	Ground
EN	3	Enable input: set V_{EN} = high to turn on the device; V_{EN} = low to turn off the device. Do not left floating.
PG	4	Power Good

DS12443 - Rev 1 page 4/21



3 Typical application diagram

Figure 4. Application diagram



DS12443 - Rev 1 page 5/21





4 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V _{IN}	Input supply voltage	-0.3 to 7	V
V _{OUT}	Output voltage	-0.3 to V _{IN} + 0.3	V
I _{OUT}	Output current	Internally limited	Α
EN	Enable pin voltage	-0.3 to V _{IN} + 0.3	V
P _D	Power dissipation	Internally limited	W
ESD	Charge device model	± 1000	V
	Human body model	± 2000	
T _{J-OP}	Operating junction temperature	- 40 to 125	°C
T _{J-MAX}	Maximum junction temperature	150	°C
T _{STG}	Storage temperature	- 55 to 150	°C

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R _{thJA}	Thermal resistance junction-ambient	202	°C/W

DS12443 - Rev 1 page 6/21



5 Electrical characteristics

- 40 °C < T_J < 125 °C , typical values refer to T_J = 25 °C, V_{IN} = V_{OUT (nom)} + 1 V or 1.6 V, whichever is greater; V_{EN} = 1.2 V; C_{IN} = 1 μ F; C_{OUT} = 1 μ F; I_{OUT} = 1 mA.

Table 4. Electrical characteristics

Symbol	Parameter Test conditions	Parameter Test conditions Min		Parameter Test conditions Min. Typ	Тур.	Max.	Unit
V _{IN}	Operating input voltage range	T _J = 25 °C	1.6		5.5	V	
V _{UVLO}	Undervoltage lockout	V _{IN} rising	1.3	1.4	1.5	V	
V _{OUT}	Output voltage accuracy (1)	V_{OUT} + 1 V < V_{IN} < 5.5 V,1 mA < I_{OUT} < 0.25 A, $V_{OUT} \ge 1.8 \text{ V}$	-2.0		+2.0	%	
		V_{OUT} + 1 V < V_{IN} < 5.5 V, 1mA < I_{OUT} < 0.25 A, V_{OUT} < 1.8 V	-3.0		+3.0		
ΔV _{OUT} / ΔV _{IN}	Static line regulation (1)	$V_{OUT} + 0.3 V < V_{IN} < 5.5 V;$		300	1500	μV/V	
	Line transient (2)	ΔV_{IN} = +/- 0.6 V, t_{rise} = t_{fall} = 30 μs		+/-1		mV	
ΔV _{OUT} /ΔΙ _{ΟUT}	Static load regulation	0 mA < I _{OUT} < 0.2 A;		50	240	μV/mA	
		1 mA < I _{OUT} < 0.3 A		0.002	0.007	%/mA	
	Load transient (2)	I_{OUT} = 1 mA to 200 mA and back t_{rise} = t_{fall} = 1 μs		+/-90		mV	
V _{DROP}	Dropout voltage (3)	I _{OUT} = 0.1 A; V _{OUT} = 3.3 V		50		mV	
		I _{OUT} = 0.2A; V _{OUT} = 3.3 V		100	180		
		I _{OUT} = 0.3 A; V _{OUT} = 3.3 V		150	230		
eN	eN Output noise voltage (2)	f = 10 Hz to 100 kHz; I _{OUT} = 1 mA		10		μV _{RMS}	
		f = 10 Hz to 100 kHz; I _{OUT} = 0.2 A		7.5	20		
		f = 10 Hz to 100 kHz; I _{OUT} = 0.3 A		7.5			
SVR	Supply voltage rejection (2)	f = 100 Hz; I _{OUT} = 20 mA		80		dB	
		f = 1 kHz ; I _{OUT} = 20 mA		80			
		f = 10 kHz ; I _{OUT} = 20 mA		75			
		f = 100 kHz ; I _{OUT} = 20 mA		60			
		f = 100 Hz; I _{OUT} = 150 mA		70			
		f = 1 kHz ; I _{OUT} = 150 mA		68			
		f = 10 kHz ; I _{OUT} = 150 mA		53			
IQ	Quiescent current	I _{OUT} = 0 A, including enable current		16	30	μA	
		I _{OUT} = 0.2 A		200	350		
		I _{OUT} = 0.3 A		240	360		
	Shutdown current	V _{EN} = 0 V		0.2	1	μA	
I _{SC}	Short-circuit current	V _{OUT} = 0 V	300	500		mA	
R _{LOW}	Output discharge resistance	V_{EN} = 0 V, de-assert V_{EN} from V_{EN_HI} to V_{EN_LO}		300	500	Ω	
V _{EN}	V _{IL} , enable input logic low	V_{OUT} + 1 $V^{(1)}$ < V_{IN} < 5.5 V			0.4	V	
	V _{IH} , enable input logic high		1.2				

DS12443 - Rev 1 page 7/21



Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
I _{EN}	Enable pin input current	$V_{IN} = V_{EN} = 5.5 \text{ V (pull-down)}$		5		μA
t _{ON1}	Rise time (SS) (2)	I_{OUT} = 0 mA to 200 mA for V_{OUT} = 10% $V_{OUT(nom)}$ to 95% $V_{OUT(nom)}$		200		μs
t _{ON2}	Turn-on time (2)	I _{OUT} = 0 mA to 200 mA, from V _{EN} assertion to 95% of V _{OUT(nom)}		450	550	μs
T _{SHDN}	Thermal shutdown (2)	I _{OUT} > 1 mA	130	160	200	°C
	Hysteresis (2)			20		
V _{PG-}	Power Good threshold	V _{OUT} decreasing	90	92	94	%V _{OUT}
V _{PG+}	voltage	V _{OUT} increasing	92	94	96	
PG _{HYS}	Power Good hysteresis	Measured at V _{OUT}		2		%V _{OUT}
PG _L	Power Good output low	De-assert V _{EN} from V _{EN_HI} to V _{EN_LO}		0.1	0.4	V
PG _{IL}	Power Good pin leakage current (2)	Measured at V _{OUT}		0.002	1	μА
PG _{RT}	Power Good reaction time			2	10	μs
PG _{RD}	Power Good delay (2)			2	10	μs

- 1. $V_{IN} = V_{OUT} + 1 \text{ V or } 1.6 \text{ V, whichever is greater. Not applicable for } 5 \text{ V output voltage versions.}$
- 2. Performance guaranteed by design and/or characterization, and 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.

Note:

Performance guaranteed over the indicated operating temperature range by design and/or characterization, and/or production tested at T_J = T_A = 25 °C. Low duty cycle pulse techniques are used during testing to maintain the junction temperature as close to ambient as possible.

Table 5. Recommended input and output capacitors

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
C _{IN}	Input capacitance	Stability	0.7	1		μF
C _{OUT}	Output capacitance		0.7	1	10	
ESR	Output/input capacitance		5		500	mΩ

DS12443 - Rev 1 page 8/21



6 Typical characteristics

The following plots are referred to LDLN030 in the typical application circuit and, unless otherwise noted, at $T_A = 25^{\circ}C$.

Figure 5. Output voltage vs. temperature (V_{IN} = 4.3 V, I_{OUT} = 1 mA)

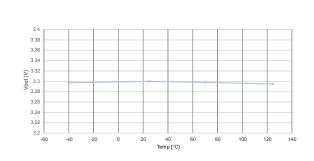


Figure 6. Output voltage vs. temperature (V_{IN} = 4.3 V, I_{OUT} = 300 mA)

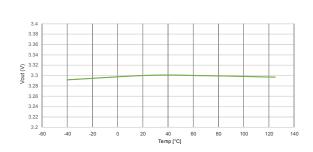


Figure 7. Load regulation vs. temperature (V_{IN} = 4.3 V, I_{OUT} from 1 mA to 300 mA)

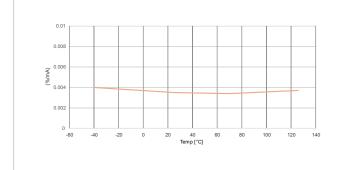


Figure 8. Line regulation vs. temperature (V_{IN} from 4.3 V to 5.5 V, I_{OUT} = 1 mA)

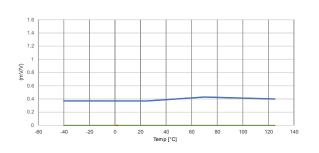


Figure 9. Quiescent current vs. temperature, (I_{OUT} = 0 mA)

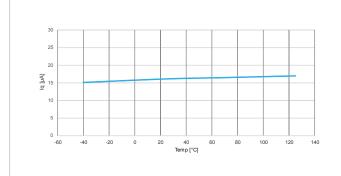
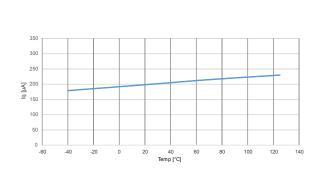


Figure 10. Quiescent current vs. temperature, (I_{OUT} = 200 mA)



DS12443 - Rev 1 page 9/21



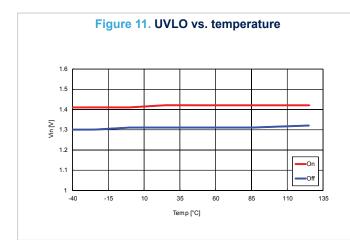
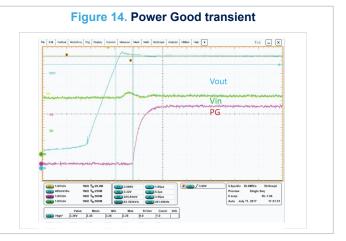


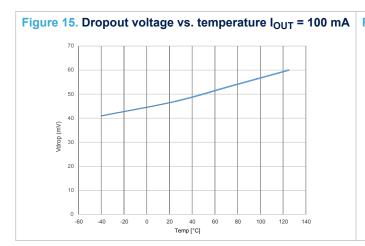
Figure 12. PG threshold vs. temperature

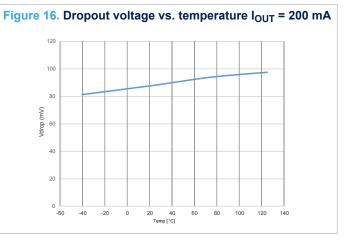
3.3
3.2
3.1
2.9
2.8
2.7
40
-15
10
35
60
85
110
135

Figure 13. Power Good transient

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DS12443 - Rev 1 page 10/21



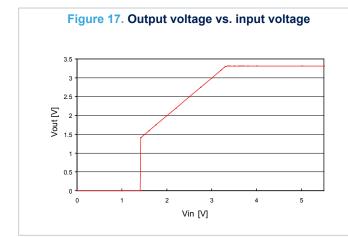
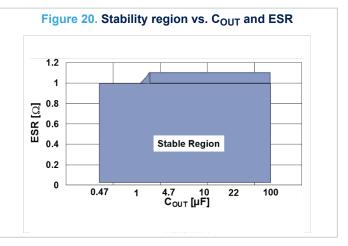
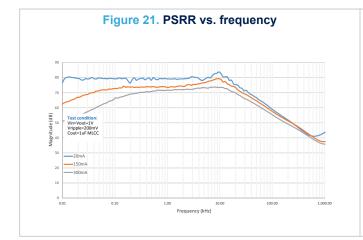
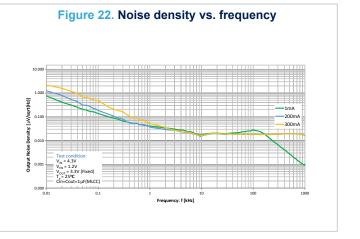


Figure 18. Short-circuit current vs. temperature

Figure 19. R_{discharge} vs. temperature

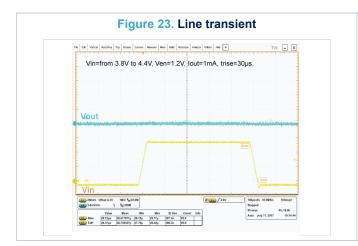


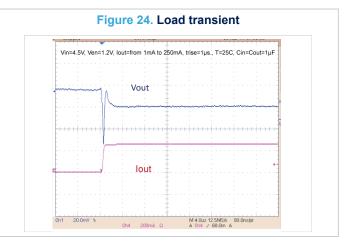


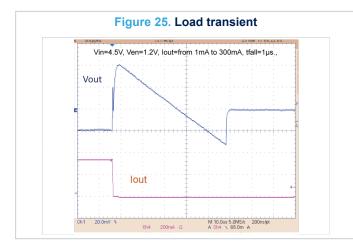


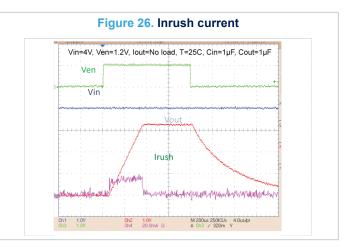
DS12443 - Rev 1 page 11/21

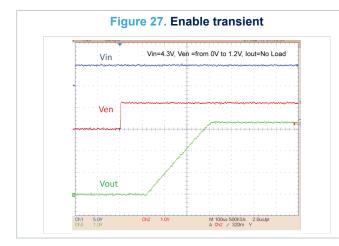


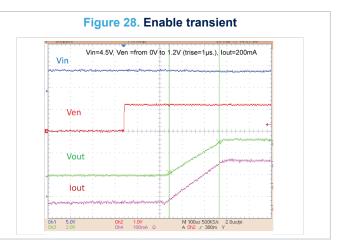












DS12443 - Rev 1 page 12/21



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.

DS12443 - Rev 1 page 13/21



7.1 TSOT23-5L package information

Figure 29. TSOT23-5L package outline

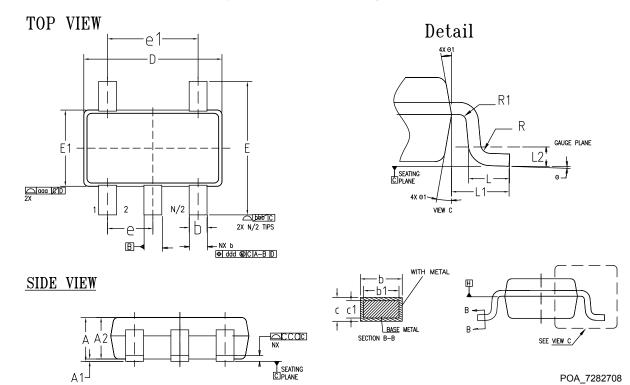


Table 6. TSOT23-5L mechanical data

Dim.	mm			
	Min.	Тур.	Max.	
A			1.00	
A1	0.01	0.05	0.10	
A2	0.84	0.87	0.90	
b	0.30		0.45	
b1	0.31	0.35	0.39	
е	0.95 BSC			
e1		1.90 BSC		
С	0.12	0.15	0.20	
c1	0.08	0.13	0.16	
D		2.90 BSC		
E		2.80 BSC		
E1	1.60 BSC			
L	0.30	0.40	0.50	
L1	0.60 REF			
L2	0.25 BSC			

DS12443 - Rev 1 page 14/21



Dim.	mm				
	Min.	Тур.	Max.		
R	0.10				
R1	0.10		0.25		
θ	0°	4°	8°		
θ1	4°	10°	12°		
N		5			

Figure 30. TSOT23-5L tape and reel drawing

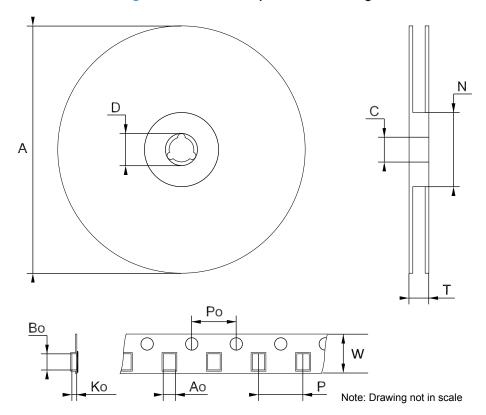


Table 7. TSOT23-5L tape and reel

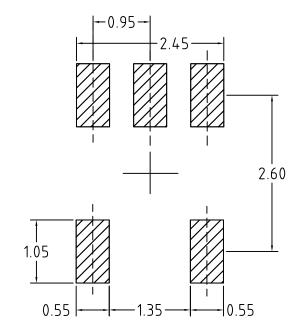
Dim.	mm			
	Min.	Тур.	Max.	
Α			180	
С	12.8	13.0	13.2	
D	20.2			
N	60			
Т			14.4	
Ao	3.13	3.23	3.33	
Во	3.07	3.17	3.27	
Ko	1.27	1.37	1.47	

DS12443 - Rev 1 page 15/21



Dim.	mm			
	Min.	Тур.	Max.	
Po	3.9	4.0	4.1	
Р	3.9	4.0	4.1	
W		8.0		

Figure 31. TSOT23-5L footprint data (dimensions are in mm)



DS12443 - Rev 1 page 16/21



Revision history

Table 8. Document revision history

Date	Revision	Changes
08-Feb-2018	1	Initial release.

DS12443 - Rev 1 page 17/21



Contents

1	Diagram	3
	Pin configuration	
3		
4		
5	Electrical characteristics	7
6	Typical characteristics	9
7	Package information	13
	7.1 TSOT23-5L package information	14
Rev	evision history	



List of tables

Table 1.	Pin description4
	Absolute maximum ratings
	Thermal data
Table 4.	Electrical characteristics
Table 5.	Recommended input and output capacitors
Table 6.	TSOT23-5L mechanical data
Table 7.	TSOT23-5L tape and reel
	Document revision history

page 20/21





List of figures

Figure 2.	Block diagram	. 3
Figure 3.	Pin connection (top view)	. 4
Figure 4.	Application diagram	. 5
Figure 5.	Output voltage vs. temperature (V _{IN} = 4.3 V, I _{OUT} = 1 mA)	. 9
Figure 6.	Output voltage vs. temperature (V _{IN} = 4.3 V, I _{OUT} = 300 mA)	. 9
Figure 7.	Load regulation vs. temperature (V _{IN} = 4.3 V, I _{OUT} from 1 mA to 300 mA)	. 9
Figure 8.	Line regulation vs. temperature (V _{IN} from 4.3 V to 5.5 V, I _{OUT} = 1 mA)	9
Figure 9.	Quiescent current vs. temperature, (I _{OUT} = 0 mA)	9
Figure 10.	Quiescent current vs. temperature, (I _{OUT} = 200 mA)	. 9
Figure 11.	UVLO vs. temperature	10
Figure 12.	PG threshold vs. temperature	10
Figure 13.	Power Good transient	10
Figure 14.	Power Good transient	10
Figure 15.	Dropout voltage vs. temperature I _{OUT} = 100 mA	10
Figure 16.	Dropout voltage vs. temperature I _{OUT} = 200 mA	10
Figure 17.	Output voltage vs. input voltage	11
Figure 18.	Short-circuit current vs. temperature	11
Figure 19.	R _{discharge} vs. temperature	11
Figure 20.	Stability region vs. C _{OUT} and ESR	11
Figure 21.	PSRR vs. frequency	11
Figure 22.	Noise density vs. frequency	11
Figure 23.	Line transient	12
Figure 24.	Load transient	12
Figure 25.	Load transient	12
Figure 26.	Inrush current	12
Figure 27.	Enable transient	12
Figure 28.	Enable transient	12
Figure 29.	TSOT23-5L package outline	14
Figure 30.	TSOT23-5L tape and reel drawing	15
Figure 31.	TSOT23-5L footprint data (dimensions are in mm)	16



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DS12443 - Rev 1 page 21/21

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