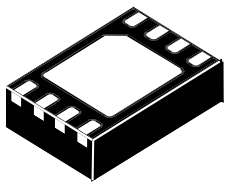
ST1L08

800 mA ultra low drop, high PSRR voltage regulator

Datasheet - production data



DFN8 2x3 mm

Features

- Input voltage from 1 to 5.5 V
- Ultra low-dropout voltage (90 mV max. @ 800 mA load)
- Low ground current (35 µA typ. @ no load)
- Output voltage tolerance: ± 2.0% @ 25 °C
- High PSRR: 80 dB @ 100 Hz, 50 dB @ 1 MHz
- 800 mA guaranteed output current
- Wide range of output voltages available on request: from 0.5 V to 4 V and adjustable
- Logic-controlled electronic shutdown
- Internal current and thermal limit
- Power Good function
- Available in DFN8 2x3 mm package
- Temperature range: -40 °C to 125 °C
- Input voltage control for the ST1L08Sxx

Applications

- Consumer
- Hard disk drives, SSD
- Computer
- Battery-powered systems
- Low voltage point of load

Description

The ST1L08 provides 0.8 A of maximum current from an input voltage in the range from 1 V to 5.5 V, with a typical dropout voltage as low as 70 mV.

It is stabilized with a ceramic capacitor on the output.

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

Enable logic control function puts the ST1L08 in shutdown mode, reducing the total current consumption.

Power Good function and input voltage control feature the ST1L08Sxx version.

The device is equipped with current limit and thermal protection.

Table 1: Device summary

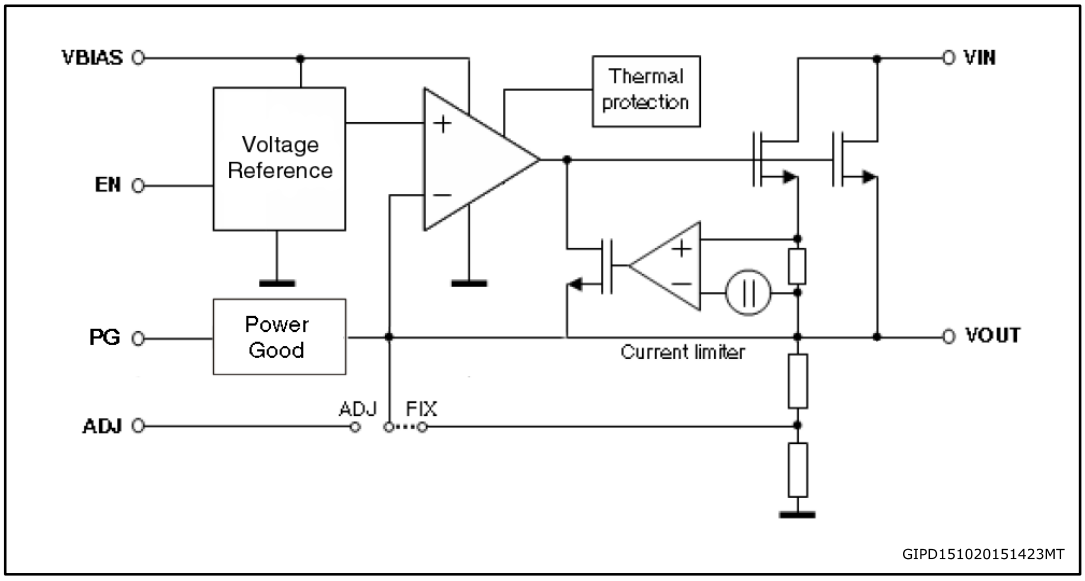
Order code	Power Good and VIN control	Package	Output voltages
ST1L08SPU12R	Yes	DFN8 (2x3 mm)	1.2 V
ST1L08SPU33R	Yes		3.3 V
ST1L08SPUR	Yes		Adjustable
ST1L08PUR	No		Adjustable

Contents

1 Diagram 3
2 Pin configuration 4
3 Typical application 5
4 Maximum ratings 6
5 Electrical characteristics 7
6 Application information 11
6.1 Thermal and short-circuit protections 11
6.2 Output voltage setting for ADJ version 11
6.3 Bias pin voltage requirements 11
6.4 External capacitors requirements 11
7 Typical characteristics 12
8 Package information 16
8.1 DFN8 (2x3 mm) package information 16
8.2 DFN8 (2x3 mm) packing information 18
9 Revision history 20

1 Diagram

Figure 1: Block diagram



2 Pin configuration

Figure 2: Pin connection (top view)

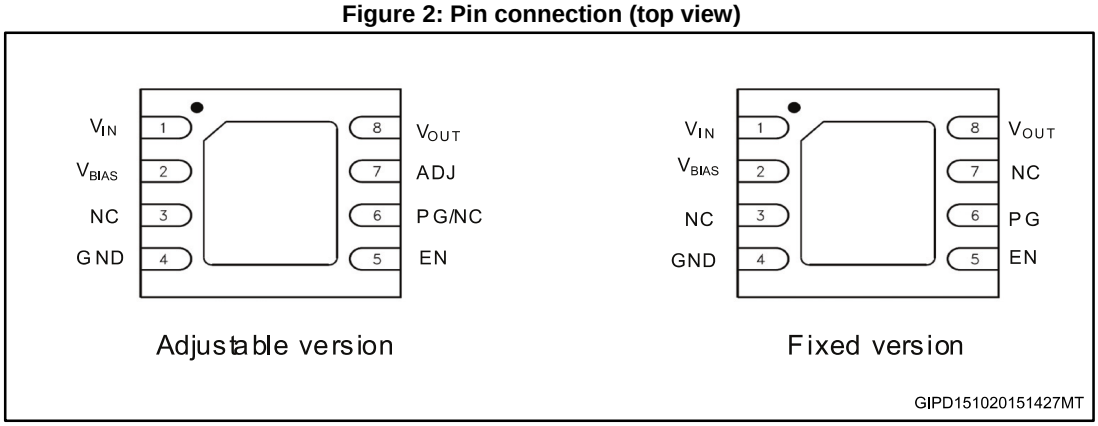
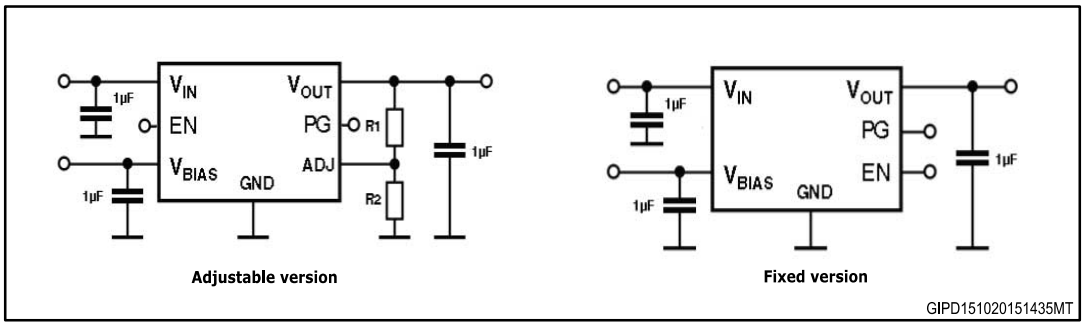


Table 2: Pin description

Symbol	Function
V_{IN}	Input voltage of the LDO (power element)
V_{BIAS}	Bias input of the LDO
GND	Common ground
EN	Enable pin logic input: low = shutdown, high = active
ADJ	Adjustable pin (on adjustable version)
V_{OUT}	Output voltage of the LDO
PG	Power Good pin (not connected on the ST1L08PUR)
NC	Not connected
EXP	Exposed pad (should be connected to GND)

3 Typical application

Figure 3: Typical application circuits



Power Good feature is not present on the ST1L08PUR.

4 Maximum ratings

Table 3: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{IN}	DC input voltage	- 0.3 to 7	V
V_{BIAS}	DC bias 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_{BIAS} + 0.3	V
V_{PG}	Power Good pin voltage	- 0.3 to V_{BIAS} + 0.3	V
V_{ADJ}	ADJ pin voltage	- 0.3 to V_{BIAS} + 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

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 4: Thermal data

Symbol	Parameter	DFN8 (2x3 mm)	Unit
R_{thJA}	Thermal resistance junction-ambient	55	°C/W
R_{thJC}	Thermal resistance junction-case	12	°C/W

5 Electrical characteristics

T_J = 25 °C, V_{IN} = 1.5 V, V_{BIAS} = 3.6 V, V_{OUT} = V_{ADJ}, C_{IN} = C_{BIAS} = 1 µF, C_{OUT} = 4.7 µF, V_{EN} = V_{BIAS}, unless otherwise specified.

Table 5: Electrical characteristics for the ST1L08 (adjustable)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage		1		5.5	V
V_{BIAS}	Operating bias voltage (1)		2.7		5.5	V
I_{IN}	V_{IN} operating current			0.2	10	µA
I_{BIAS}	V_{BIAS} operating current	I_{OUT} = 10 µA		40	150	µA
V_{ADJ}	V_{ADJ} accuracy	I_{OUT} = 1 mA to 800 mA T_J = 25 °C	0.490	0.500	0.510	V
		-40 °C < T_J < 125 °C V_{OUT} = 0.5 V	0.487	0.500	0.512	
ΔV_{OUT}	V_{IN} static line regulation	I_{OUT} = 1 mA V_{OUT} = 0.5 V V_{BIAS} = 3.6 V 1 V ≤ V_{IN} ≤ 5.5 V		0.002	0.01	%/V
	V_{BIAS} static line regulation	I_{OUT} = 100 mA V_{OUT} = 0.5 V V_{IN} = 1.5 V 2.7 V ≤ V_{BIAS} ≤ 5.5 V		0.04	0.2	%/V
ΔV_{OUT}	Static load regulation	I_{OUT} = 1 mA to 800 mA		0.0002	0.001	%/mA
V_{DROP}	Dropout voltage	I_{OUT} = 800 mA V_{BIAS} = 3.6 V		70	90	mV
		40 °C < T_J < 125 °C			120	
e_N	Output noise voltage	10 Hz to 100 kHz I_{OUT} = 10 mA		50		μV_{RMS}
SVR	Supply voltage rejection	V_{IN} > V_{OUT} + 0.5 V +/- V_{RIPPLE} V_{RIPPLE} = 0.1 V f = 100 Hz		80		dB
		f = 10 kHz		60		
		f = 1 MHz		50		

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{GND}	Ground current	I_{OUT} = 0 mA T_J = 25 °C		35		
		I_{OUT} = 500 mA T_J = 25 °C		40		
		I_{OUT} = 800 mA 40 °C < T_J < 125 °C		40	150	µA
I_{SC}	Short-circuit current	R_L = 0		1.8		A
V_{EN}	Enable input logic low				0.8	
	Enable input logic high		1.3			V
I_{EN}	Enable pin input current	V_{EN} = 1.3 V			1	µA
PG (2)	Power Good output threshold	Rising edge		0.92* V_{OUT}		V
		Falling edge		0.8* V_{OUT}		
	Power Good output voltage low	I_{sink} = 6 mA open drain output			0.4	V
T_{SHDN}	Thermal shutdown			165		
	Hysteresis			20		°C

Notes:

(1)Important: in any case $V_{BIAS} \geq V_{OUT}$ + 1.5 V.

(2)Power Good feature is not available on the ST1L08PUR.

T_J = 25 °C, V_{IN} = V_{OUT} + 0.5 V, V_{BIAS} = V_{OUT} + 1.5 V[a], C_{IN} = C_{BIAS} = 1 µF, C_{OUT} = 4.7 µF, V_{EN} = V_{BIAS}, unless otherwise specified.

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage		1		5.5	V
V_{BIAS}	Operating bias voltage (1)		2.7		5.5	V
V_{OUT}	Output voltage range		0.5		4	V
I_{IN}	V_{IN} operating current			4	10	µA
I_{BIAS}	V_{BIAS} operating current	I_{OUT} = 10 µA		45	150	µA
V_{OUT}	V_{OUT} accuracy	I_{OUT} = 1 mA to 800 mA T_J = 25 °C	-2		2	
		-40 °C < T_J < 125 °C	-2.5		2.5	%
ΔV_{OUT}	V_{IN} static line regulation	I_{OUT} = 1 mA V_{BIAS} = V_{OUT} + 1.5 V V_{OUT} + 0.5 V ≤ V_{IN} ≤ 5.5 V		0.003	0.015	%/V
	V_{BIAS} static line regulation	I_{OUT} = 100 mA V_{IN} = V_{OUT} + 0.5 V V_{OUT} + 1.5 V ≤ V_{BIAS} ≤ 5.5 V		0.04	0.2	%/V
ΔV_{OUT}	Static load regulation	I_{OUT} = 1 mA to 800 mA		0.0005	0.0025	%/mA
V_{DROP}	Dropout voltage	I_{OUT} = 800 mA V_{BIAS} = 4.8 V V_{OUT} = 3.3 V		100		mV
		40 °C < T_J < 125 °C			150	
eN	Output noise voltage	10 Hz to 100 kHz I_{OUT} = 10 mA V_{OUT} = 3.3 V		200		μV_{RMS}
SVR	Supply voltage rejection	V_{IN} > V_{OUT} + 0.5 V +/- V_{RIPPLE} V_{RIPPLE} = 0.1 V f = 100 Hz		70		dB
		f = 10 kHz		53		
		f = 1 MHz		30		
I_{GND}	Ground current	I_{OUT} = 0 mA T_J = 25 °C		40		µA
		I_{OUT} = 500 mA T_J = 25 °C		50		

[a] Important: in any case V_{BIAS} ≥ V_{OUT} + 1.5 V.

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
		I_{OUT} = 800 mA, 40 °C < T_J < 125 °C		50	150	
I_{SC}	Short-circuit current	R_L = 0		1.8		A
V_{EN}	Enable input logic low				0.8	V
	Enable input logic high		1.3			
I_{EN}	Enable pin input current	V_{EN} = 1.3 V			1	µA
PG	Power Good output threshold	Rising edge		0.92 * V_{OUT}		V
		Falling edge		0.8 * V_{OUT}		
	Power Good output voltage low	I_{sink} = 6 mA open drain output			0.4	V
T_{SHDN}	Thermal shutdown			165		°C
	Hysteresis			20		

Notes:

(1)Important: in any case $V_{BIAS} \geq V_{OUT}$ + 1.5 V.

6 Application information

6.1 Thermal and short-circuit protections

The ST1L08 is self-protected from short-circuit condition and overtemperature. When the output load is higher than the one supported by the device, the output current increases until the limit of typically 1.8 A is reached, at this point the current is kept constant even when the load impedance is zero.

Thermal protection acts when the junction temperature reaches 165 °C typical. At this point the output of the IC shuts down. As soon as the junction temperature falls below the thermal hysteresis value the device starts working again.

In order to calculate the maximum power that the device can dissipate, keeping the junction temperature below the TOP, the following formula is used:

Equation 1

$$P_{DMAX} = (125 - T_{AMB})/R_{THJA}$$

6.2 Output voltage setting for ADJ version

In the adjustable version, the output voltage can be set from 0.5 V up to 4 V, by connecting a resistor divider between the ADJ pin and the output, thus allowing remote voltage sensing.

The resistor divider should be selected using the following equation:

Equation 2

$$V_{OUT} = V_{ADJ} (1 + R1 / R2), \text{ with } V_{ADJ} = 0.5 \text{ V (typ.)}$$

The resistors to be used, should have values in the range from 10 kΩ to 100 kΩ.

Lower values can also be suitable, but they increase current consumption.

6.3 Bias pin voltage requirements

The bias input is designed for low drop applications. The bias pin must be at least 2.7 V, and at least 1.5 V higher than the output, to ensure proper biasing to the N-channel power pass transistor.

If V_{IN} supply voltage meets these requirements, the bias pin can be tied to V_{IN}.

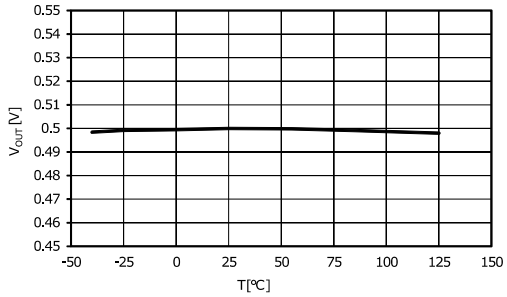
6.4 External capacitors requirements

The regulator is designed to be stable with ultra low ESR ceramic capacitors on the input and the output. The suggested minimum value of the input, bias and output capacitors is 1 µF. The input capacitor must be connected as closer as possible to the V_{IN} terminal. The output capacitor must also be connected as closer as possible to the output pin.

7 Typical characteristics

T_J = 25 °C, V_{IN} = 1.5 V, V_{BIAS} = 3.6 V, V_{OUT} = V_{ADJ}, C_{IN} = C_{BIAS} = 1 µF, C_{OUT} = 4.7 µF, V_{EN} = V_{BIAS}, unless otherwise specified.

Figure 4: Output voltage vs. temperature (adjustable, I_{OUT} = 1 mA)



V_{OUT} = V_{ADJ}, V_{BIAS} = V_{EN} = 3.6 V, V_{IN} = 1.5 V, I_{OUT} = 1 mA

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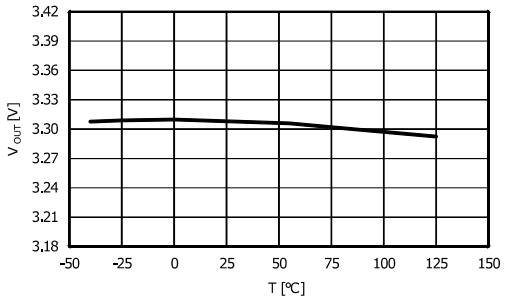
Figure 5: Output voltage vs. temperature (fixed 3.3 V, I_{OUT} = 1 mA)



V_{OUT} = 3.3 V, V_{IN} = 5.5 V, V_{BIAS} = V_{EN} = 4.8 V, I_{OUT} = 1 mA

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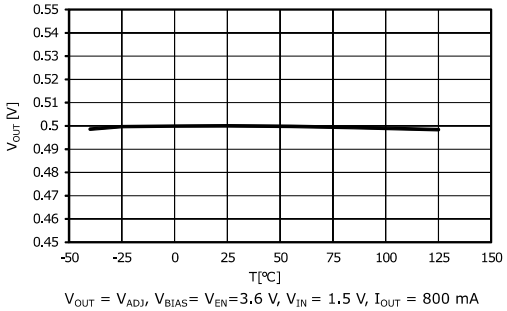
Figure 6: Output voltage vs. temperature (adjustable, I_{OUT} = 800 mA)



V_{OUT} = V_{ADJ}, V_{BIAS}= V_{EN}=3.6 V, V_{IN} = 1.5 V, I_{OUT} = 800 mA

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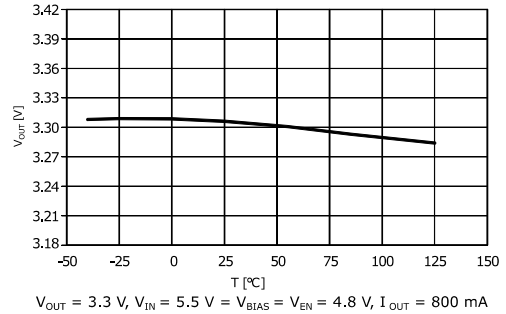
Figure 7: Output voltage vs.temperature (fixed 3.3 V, I_{OUT} = 800 mA)



V_{OUT} = 3.3 V, V_{IN} = 5.5 V = V_{BIAS} = V_{EN} = 4.8 V, I_{OUT} = 800 mA

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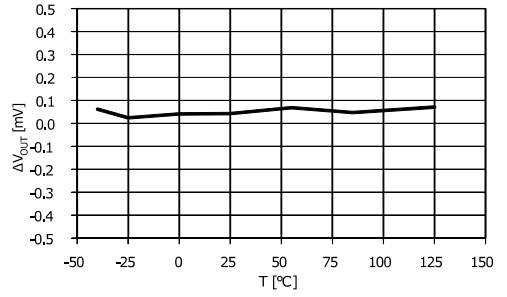
Figure 8: V_{IN} line regulation vs. temperature (adjustable)



V_{IN} = 1.0 to 5.5 V, V_{BIAS} = 3.6 V, I_{OUT} = 1 mA, V_{OUT} = 0.5 V

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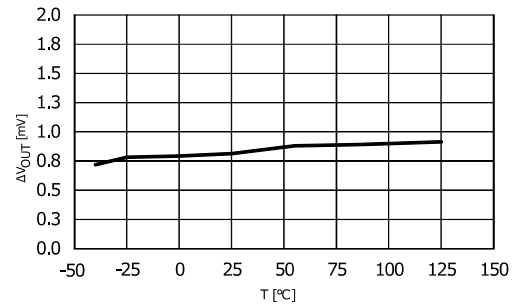
Figure 9: V_{BIAS} line regulation vs. temperature (adjustable)



V_{IN} = 1.0 V, V_{BIAS} = 2.7 to 5.5 V, I_{OUT} = 100 mA, V_{OUT} = 0.5 V

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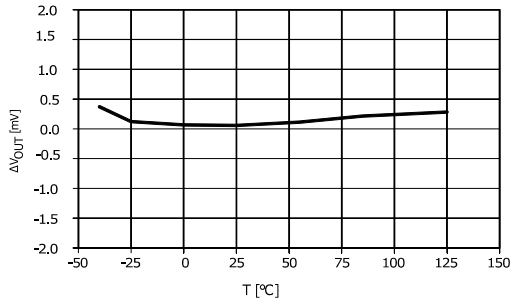
Figure 10: Load regulation vs. temperature (adjustable)



V_{IN} = 1.5 V, V_{BIAS} = 3.6 V, I_{OUT} = 1 mA to 0.8 A

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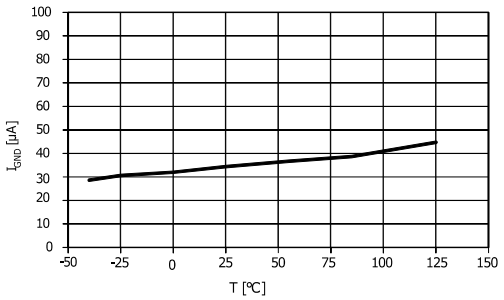
Figure 11: Ground current vs. temperature (adjustable, I_{OUT} = 0 mA)



V_{IN} = 1.5 V, V_{BIAS} = 3.6 V, I_{OUT} = 0 mA

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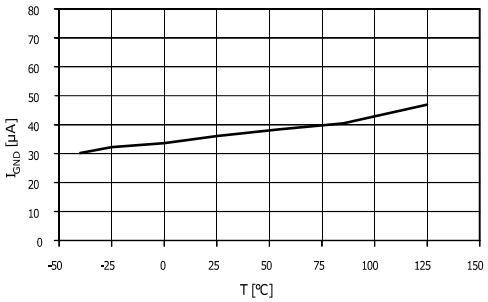
Figure 12: Ground current vs. temperature (adjustable, I_{OUT} = 500 mA)



V_{IN} = 1.5 V, V_{BIAS} = 3.6 V, I_{OUT} = 500 mA

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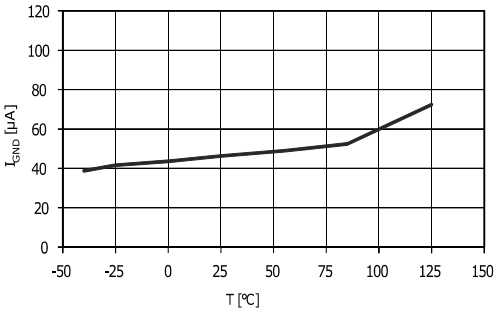
Figure 13: Ground current vs. temperature (adjustable, I_{OUT} = 800 mA)



V_{IN} = 5.5 V, V_{BIAS} = 5.5 V, I_{OUT} = 800 mA

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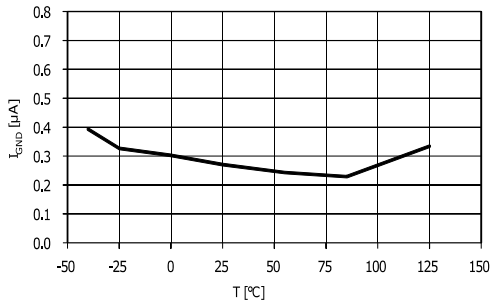
Figure 14: Ground current in off mode vs. temperature (adjustable)



V_{IN} = 1.5 V, V_{BIAS} = 3.6 V, V_{EN} = 0 V, I_{OUT} = 0 mA

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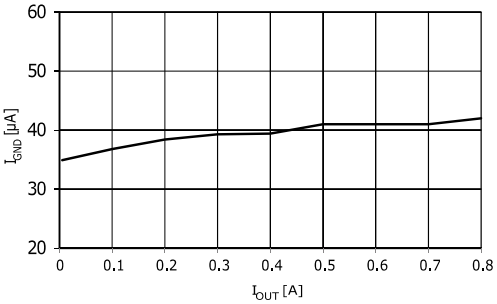
Figure 15: Ground current vs. output current (adjustable)



V_{IN} = 1.5 V, V_{BIAS} = V_{EN} = 3.6 V, V_{OUT} = V_{ADJ}, T = 25 °C

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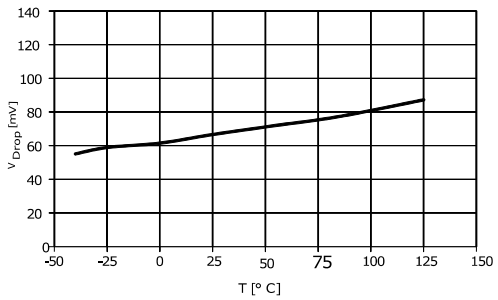
Figure 16: Dropout voltage vs. temperature (adjustable)



V_{BIAS} = V_{EN} = 3.6 V, I_{OUT} = 800 mA

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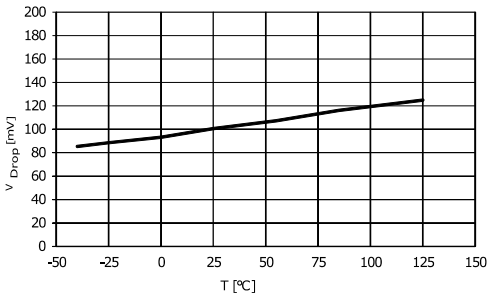
Figure 17: Dropout voltage temperature (fixed 3.3 V)



V_{BIAS} = V_{EN} = 3.6 V, I_{OUT} = 800 mA

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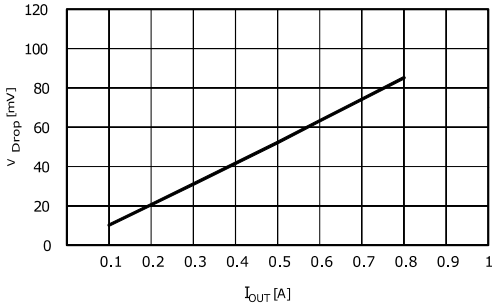
Figure 18: Dropout voltage vs. output current



V_{BIAS} = V_{EN} = 5.5 V, V_{OUT} = 3.9 V, T = 25 °C

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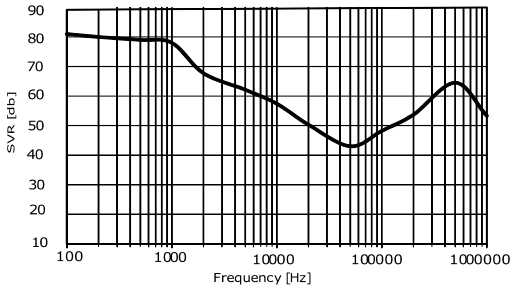
Figure 19: Supply voltage rejection vs. frequency



V_{OUT} = V_{ADJ}, V_{IN} = 1 V±0.1 V Ripple, V_{EN} = High, V_{BIAS} = 3.6 V, T = 25 °C, I_{OUT} = 100 mA, C_{IN} = C_{BIAS} = 1 µF, C_{OUT} = 10 µF

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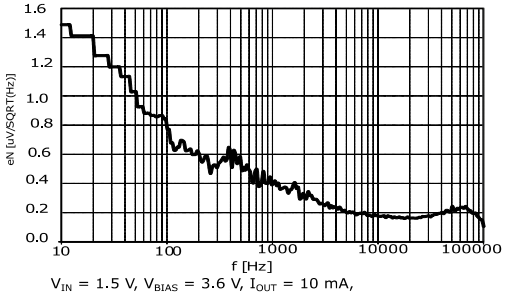
Figure 20: Output noise spectral density



V_{IN} = 1.5 V, V_{BIAS} = 3.6 V, I_{OUT} = 10 mA,
V_{OUT} = V_{ADJ}, C_{IN} =1 µF, C_{OUT} = 4.7 µF

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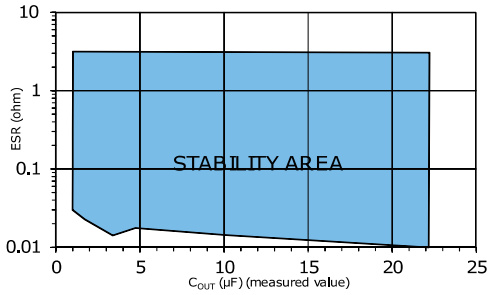
Figure 21: Stability area vs. (C_{OUT}, ESR)



V_{OUT} = V_{ADJ} , V_{BIAS} = from 2 V to 5.5 V, V_{EN} = High,
V_{IN} = from 1 V to 5.5 V, T = 25 °C,
I_{OUT} = 1 mA to 0.8 A, C_{IN} = C_{BIAS} = 1 µF

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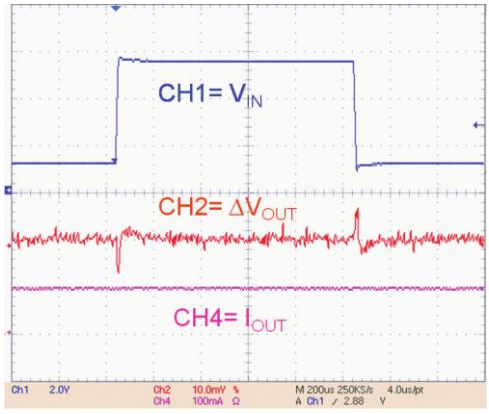
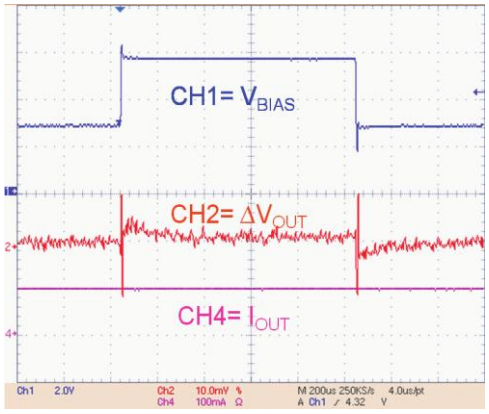
Figure 22: V_{IN} line transient



$V_{OUT} = V_{ADJ}$, V_{IN} from 1V to 5.5V, V_{BIAS} = 3.6V, I_{OUT} = 100mA, t_{RISE}=10µs

GIPD201020150847MT

Figure 23: V_{BIAS} line transient



$V_{OUT} = V_{ADJ}$, V_{IN} =1.5V, V_{BIAS} = from 2.7V to 5.5V, I_{OUT} = 100mA, t_{RISE} = 3µs

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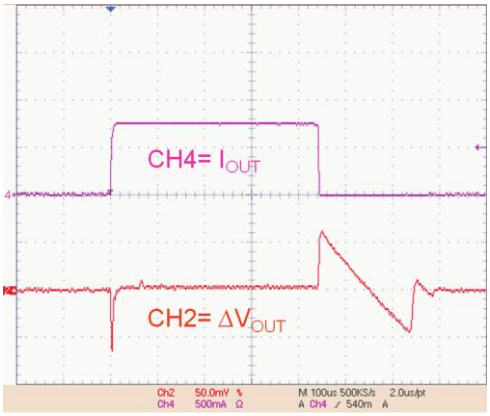
Figure 24: Load transient, C_{OUT} = 4.7 µF



$V_{OUT} = V_{ADJ}$, V_{IN} =1V, V_{BIAS}=2.7V, I_{OUT}=from 5mA to 800mA, C_{OUT}=4.7µF

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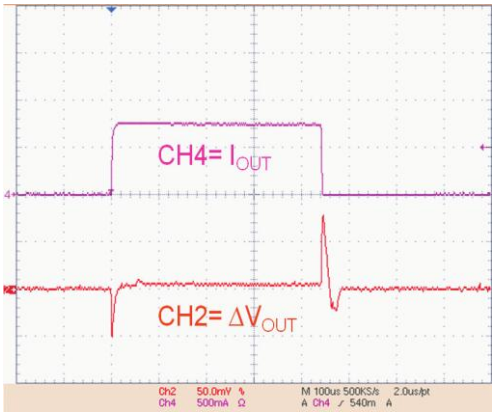
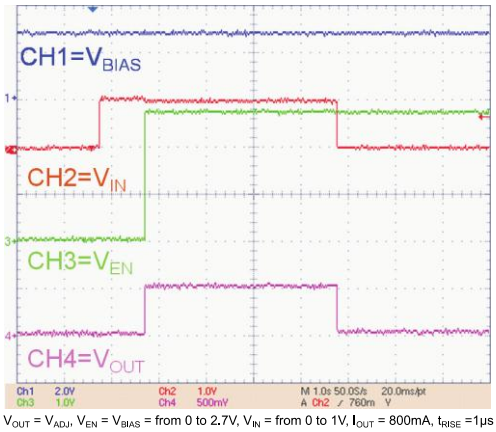
Figure 25: Load transient, C_{OUT} =1 µF



$V_{OUT} = V_{ADJ}$, V_{IN} =1V, V_{BIAS}= 2.7V, I_{OUT} = from 5mA to 800mA, C_{OUT}=1µF

GIPD201020150850MT

Figure 26: Enable transient, V_{BIAS} before V_{IN}



$V_{OUT} = V_{ADJ}$, $V_{EN} = V_{BIAS}$ = from 0 to 2.7V, V_{IN} = from 0 to 1V, I_{OUT} = 800mA, t_{RISE} =1µs

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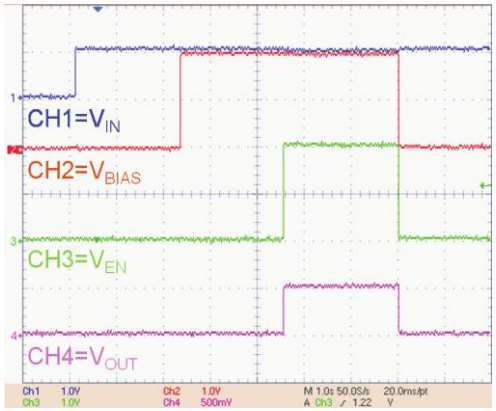
Figure 27: Enable transient V_{IN} before V_{BIAS}



$V_{OUT} = V_{ADJ}$, V_{IN} = from 0 to 1V, V_{EN}=V_{BIAS}= from 0 to 2V, I_{OUT}= 800mA, t_{RISE} = 10µs

GIPD201020150852MT

8 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.

8.1 DFN8 (2x3 mm) package information

Figure 28: DFN8 (2x3 mm) package outline

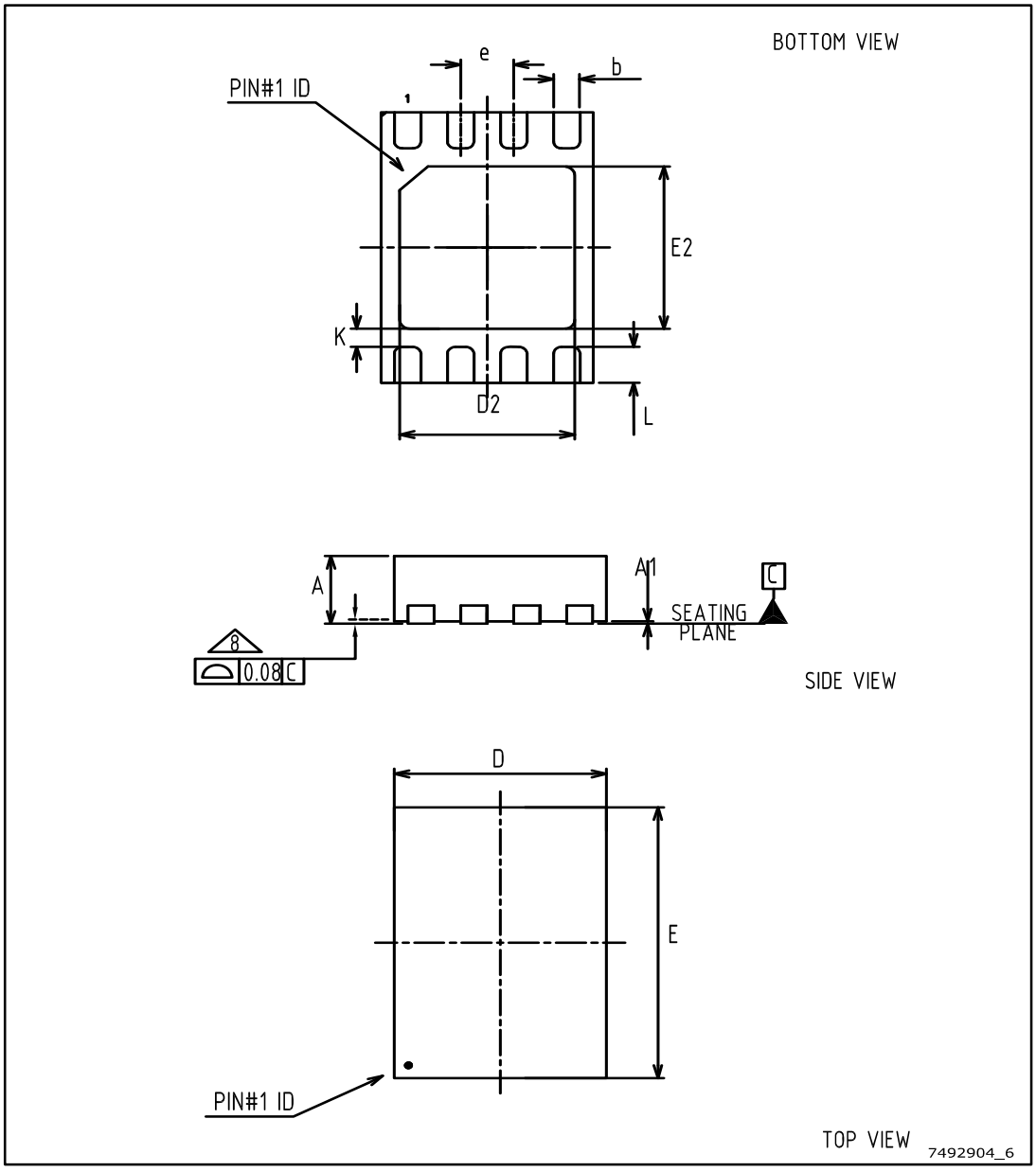
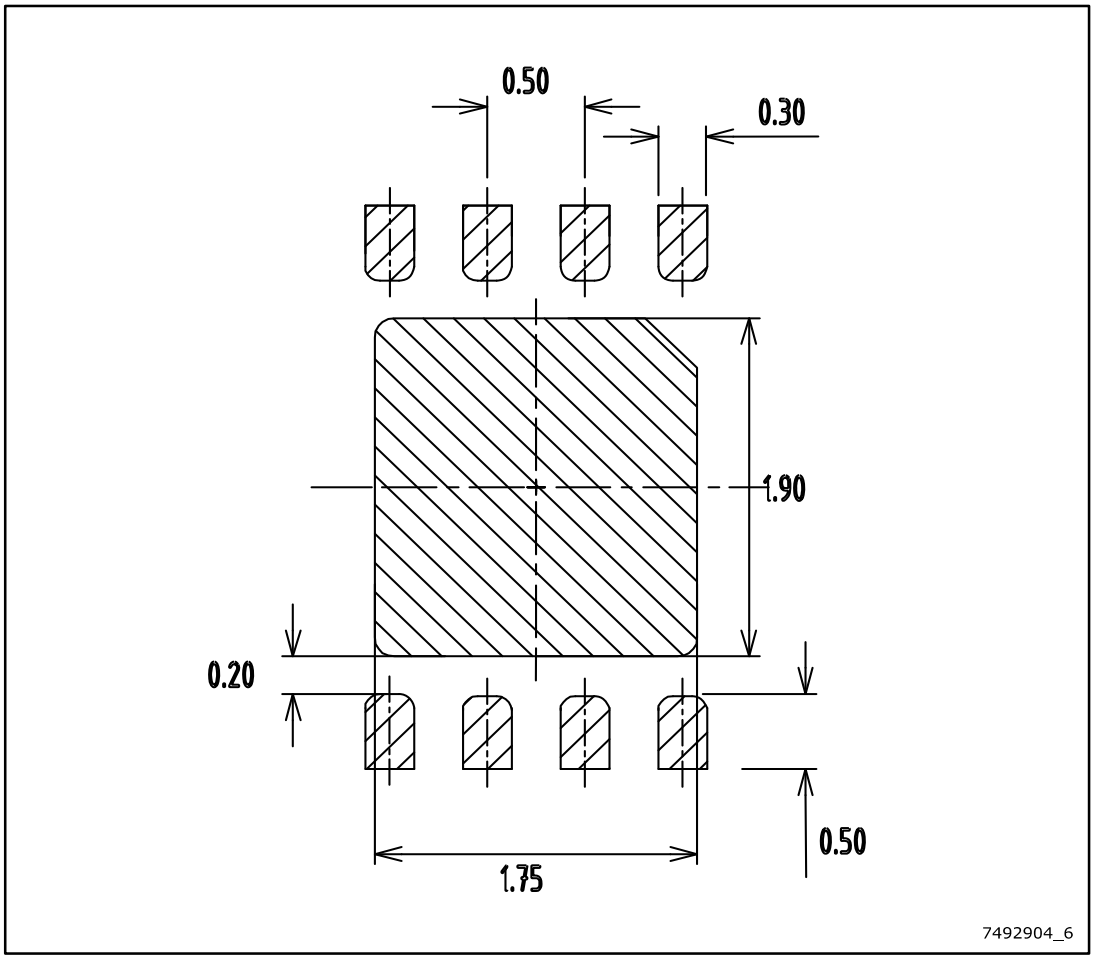


Table 6: DFN8 (2x3 mm) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80	0.90	1.00
A1	0.00	0.02	0.05
b	0.18	0.25	0.30
c		0.10	
D		2.00	
E		3.00	
D2	1.50	1.65	1.75
E2	1.65	1.80	1.90
e		0.50	
L	0.30	0.40	0.50
K		0.20	

Figure 29: DFN8 (2x3 mm) recommended footprint



8.2 DFN8 (2x3 mm) packing information

Figure 30: DFN8 (2x3 mm) tape outline

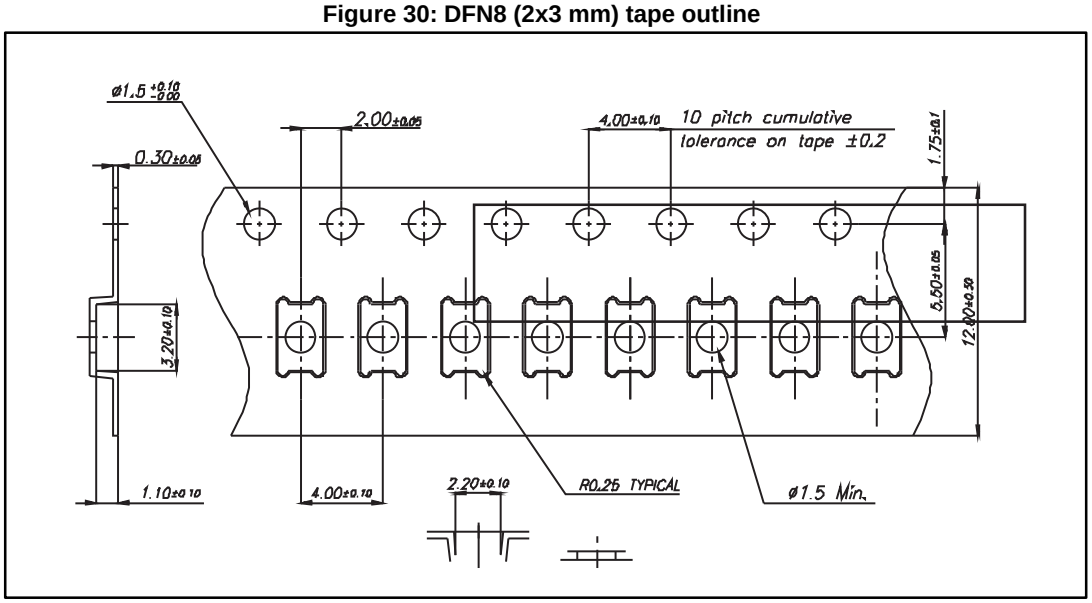


Figure 31: DFN8 (2x3 mm) reel outline

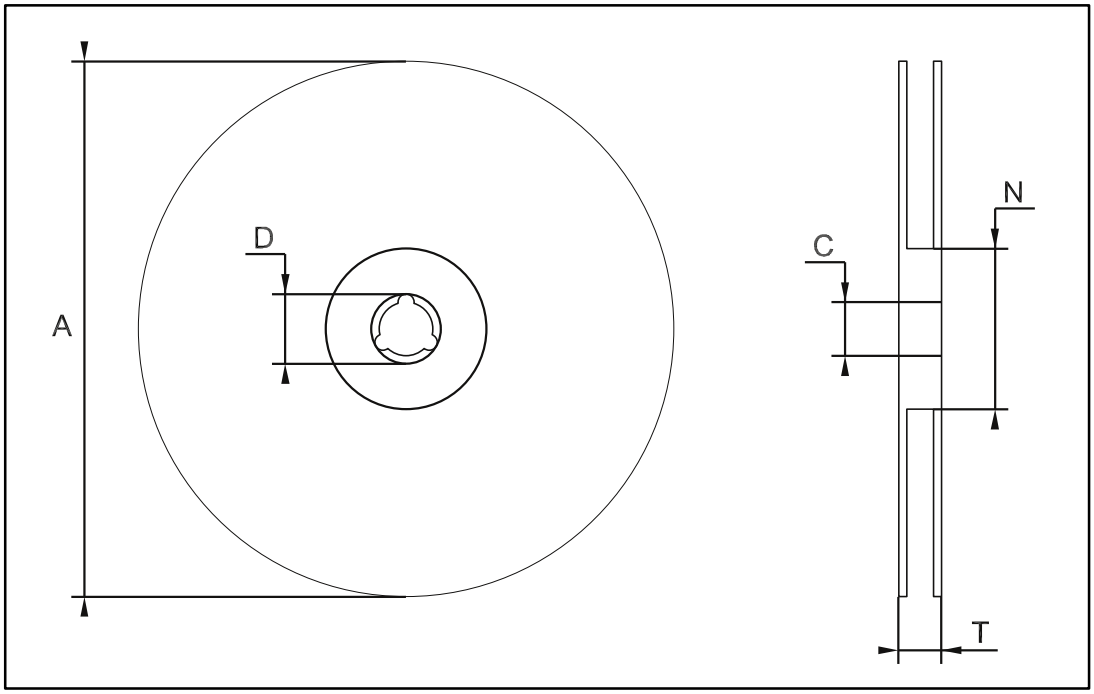


Table 7: DFN8 (2x3 mm) tape and reel mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			180
C		12.8	13.2
D		20.2	
N		60	
T			14.4

9 Revision history

Table 8: Document revision history

Date	Revision	Changes
23-Oct-2014	1	First release.
16-Nov-2015	2	Updated *Table 5: "Electrical characteristics for the ST1L08 (adjustable)"*. Minor text changes.

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