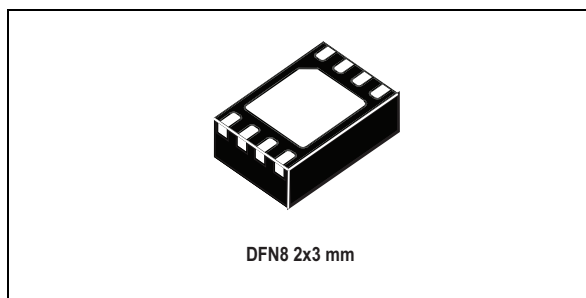


800 mA ultra low drop, high PSRR voltage regulator

Datasheet - production data



Features

- Input voltage from 1 to 5.5 V
- Ultra low-dropout voltage (90 mV max. @ 800 mA load)
- Low ground current (35 μ A typ. @ no load)
- Output voltage tolerance: $\pm 2.0\%$ @ 25 $^{\circ}$ 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 $^{\circ}$ C to 125 $^{\circ}$ 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

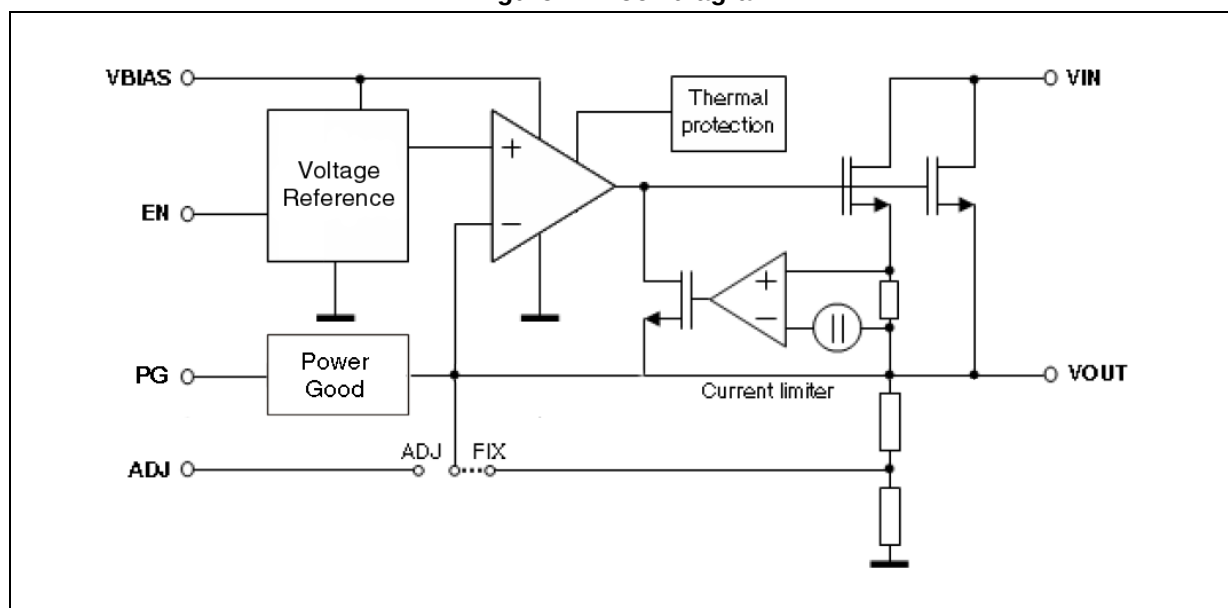
Order codes	Power Good and V_{IN} control	Package	Output voltages
ST1L08SPU12R	Yes	DFN8 (2x3 mm)	1.2 V
ST1L08SPU33R	Yes		3.3 V
ST1L08SPUR	Yes		Adjustable
ST1L08PUR	No		Adjustable

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1 Diagram

Figure 1. Block diagram



2 Pin configuration

Figure 2. Pin connection (top view)

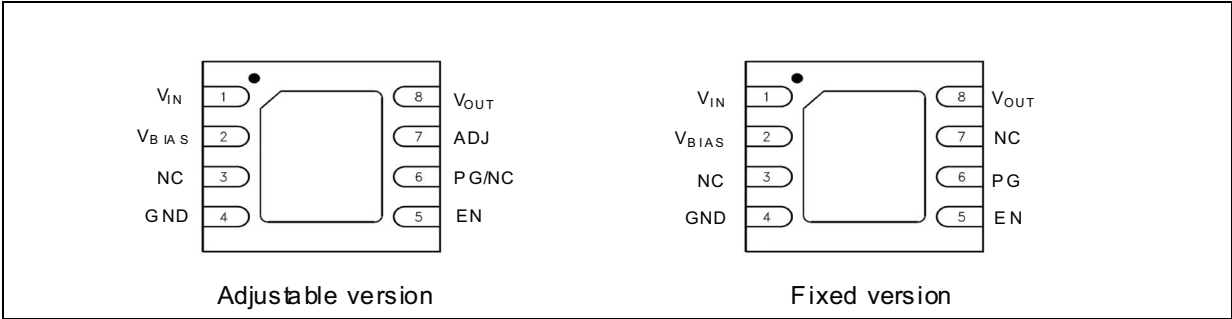
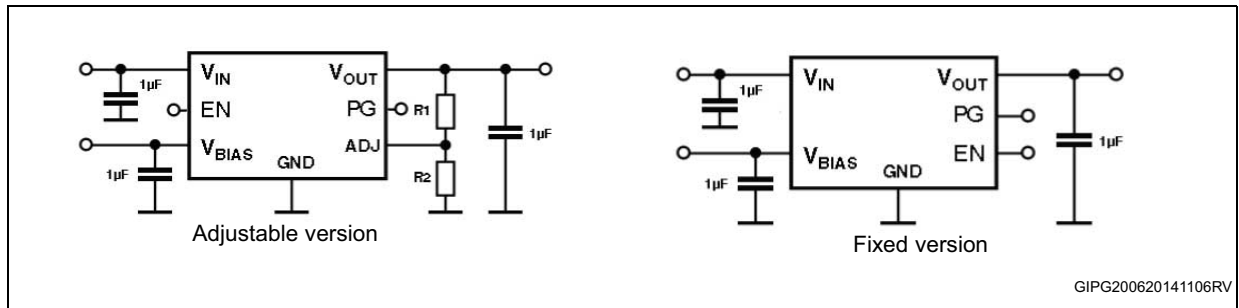


Table 2. Pin description

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⁽¹⁾



1. 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_{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

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 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

$T_J = 25\text{ }^{\circ}\text{C}$, $V_{IN} = 1.5\text{ V}$, $V_{BIAS} = 3.6\text{ V}$, $V_{OUT} = V_{ADJ}$, $C_{IN} = C_{BIAS} = 1\text{ }\mu\text{F}$, $C_{OUT} = 4.7\text{ }\mu\text{F}$, $V_{EN} = V_{BIAS}$, 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	$I_{OUT} = 10\text{ }\mu\text{A}$		40	150	μA
V_{ADJ}	V_{ADJ} accuracy	$I_{OUT} = 1\text{ mA to }800\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$	0.490	0.500	0.510	V
		$-40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$, $V_{OUT} = 0.5\text{ V}$	0.487	0.500	0.512	
ΔV_{OUT}	V_{IN} static line regulation	$I_{OUT} = 1\text{ mA}$, $V_{OUT} = 0.5\text{ V}$ $V_{BIAS} = 3.6\text{ V}$ $1\text{ V} \leq V_{IN} \leq 5.5\text{ V}$		0.002	0.01	%/V
	V_{BIAS} static line regulation	$I_{OUT} = 100\text{ mA}$, $V_{OUT} = 0.5\text{ V}$ $V_{IN} = 1.5\text{ V}$ $2.7\text{ V} \leq V_{BIAS} \leq 5.5\text{ V}$		0.04	0.2	%/V
ΔV_{OUT}	Static load regulation	$I_{OUT} = 1\text{ mA to }800\text{ mA}$		0.0002	0.001	%/mA
V_{DROP}	Dropout voltage	$I_{OUT} = 800\text{ mA}$, $V_{BIAS} = 3.6\text{ V}$		70	90	mV
		$40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$			120	
e_N	Output noise voltage	10 Hz to 100 kHz, $I_{OUT} = 10\text{ mA}$		50		μV_{RMS}
SVR	Supply voltage rejection	$V_{IN} > V_{OUT} + 0.5\text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$ $f = 100\text{ Hz}$		80		dB
		$f = 10\text{ kHz}$		60		
		$f = 1\text{ MHz}$		50		
I_{GND}	Ground current	$I_{OUT} = 0\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$		35		μA
		$I_{OUT} = 500\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$		40		
		$I_{OUT} = 800\text{ mA}$, $40\text{ }^{\circ}\text{C} < T_J < 125\text{ }^{\circ}\text{C}$		40	150	
I_{SC}	Short-circuit current	$R_L = 0$		40		A
V_{EN}	Enable input logic low				0.8	V
	Enable input logic high		1.3			
I_{EN}	Enable pin input current	$V_{EN} = 1.3\text{ V}$			1	μA

Table 5. Electrical characteristics for the ST1L08 (adjustable) (continued)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
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		°C
	Hysteresis			20		

1. Important: in any case V_{BIAS} ≥ 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⁽¹⁾, C_{IN} = C_{BIAS} = 1 μF, C_{OUT} = 4.7 μF,
V_{EN} = V_{BIAS}, unless otherwise specified

Table 6. Electrical characteristics for the ST1L08 (fixed)

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	
e _N	Output noise voltage	10 Hz to 100 kHz, I _{OUT} = 10 mA, V _{OUT} = 3.3 V		200		μV _{RMS}

Table 6. Electrical characteristics for the ST1L08 (fixed) (continued)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
SVR	Supply voltage rejection	$V_{IN} > V_{OUT} + 0.5 \text{ V} \pm V_{RIPPLE}$ $V_{RIPPLE} = 0.1 \text{ V}$ $f = 100 \text{ Hz}$		70		dB
		$f = 10 \text{ kHz}$		53		
		$f = 1 \text{ MHz}$		30		
I_{GND}	Ground current	$I_{OUT} = 0 \text{ mA}$, $T_J = 25 \text{ }^\circ\text{C}$		40		μA
		$I_{OUT} = 500 \text{ mA}$, $T_J = 25 \text{ }^\circ\text{C}$		50		
		$I_{OUT} = 800 \text{ mA}$, $40 \text{ }^\circ\text{C} < T_J < 125 \text{ }^\circ\text{C}$		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	$V_{EN} = 1.3 \text{ V}$			1	μA
PG	Power Good output threshold	Rising edge		$0.92 \cdot V_{OUT}$		V
		Falling edge		$0.8 \cdot V_{OUT}$		
	Power Good output voltage low	$I_{sink} = 6 \text{ mA}$ open drain output			0.4	V
T_{SHDN}	Thermal shutdown			165		$^\circ\text{C}$
	Hysteresis			20		

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

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 T_{OP} , 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

$T_J = 25\text{ }^{\circ}\text{C}$, $V_{IN} = 1.5\text{ V}$, $V_{BIAS} = 3.6\text{ V}$, $V_{OUT} = V_{ADJ}$, $C_{IN} = C_{BIAS} = 1\text{ }\mu\text{F}$, $C_{OUT} = 4.7\text{ }\mu\text{F}$, $V_{EN} = V_{BIAS}$, unless otherwise specified

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

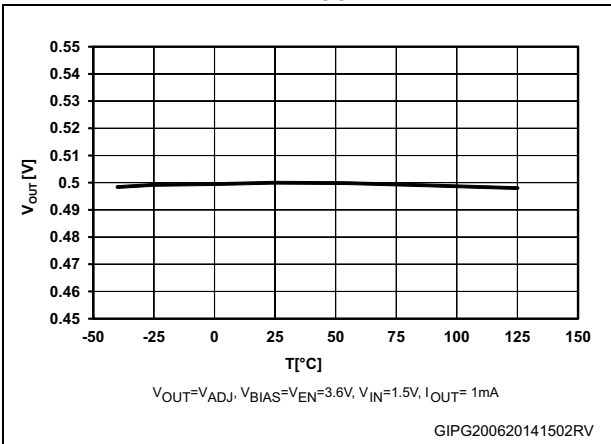


Figure 5. Output voltage vs. temperature (fixed 3.3 V, $I_{OUT} = 1\text{ mA}$)

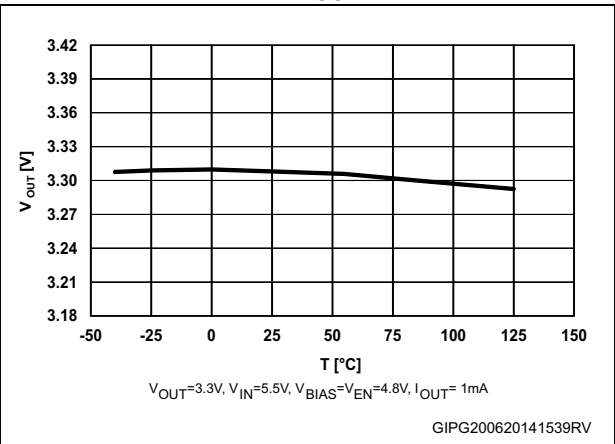


Figure 6. Output voltage vs. temperature (adjustable, $I_{OUT} = 800\text{ mA}$)

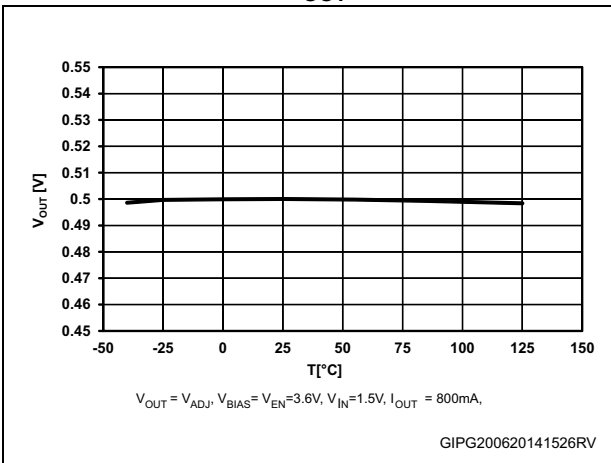


Figure 7. Output voltage vs. temperature (fixed 3.3 V, $I_{OUT} = 800\text{ mA}$)

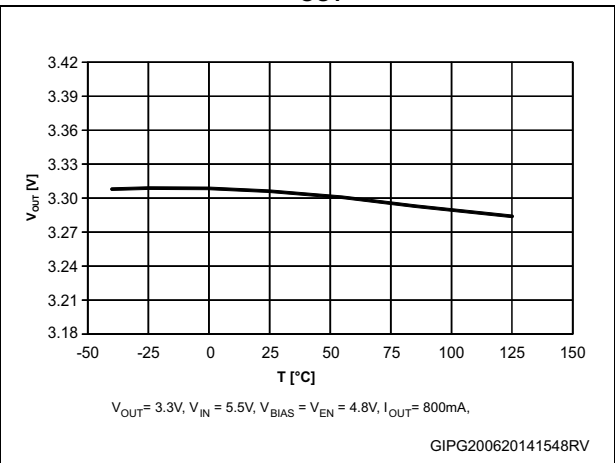


Figure 8. V_{IN} line regulation vs. temperature (adjustable)

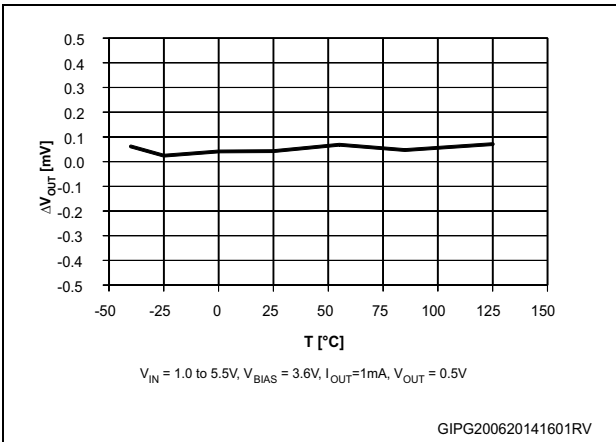


Figure 9. V_{BIAS} line regulation vs. temperature (adjustable)

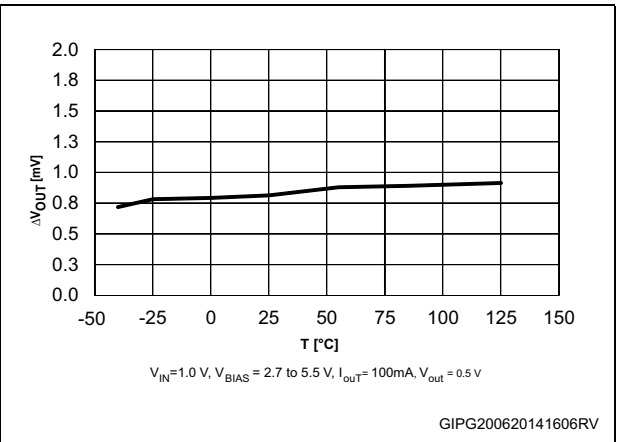


Figure 10. Load regulation vs. temperature (adjustable)

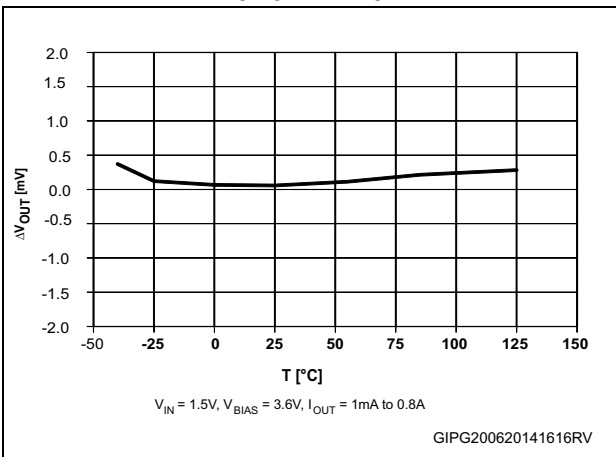


Figure 11. Ground current vs. temperature (adjustable, $I_{OUT} = 0\text{ mA}$)

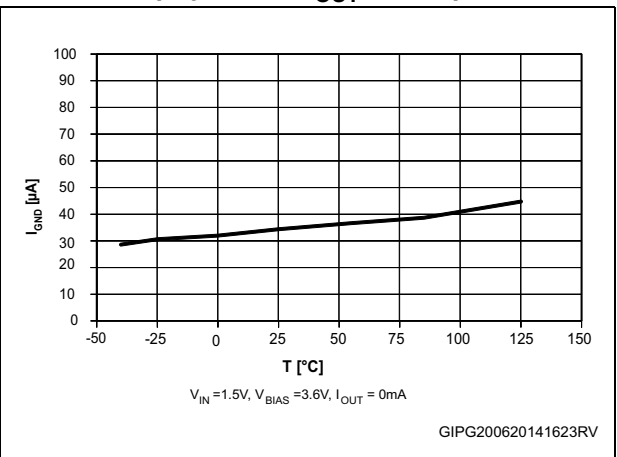


Figure 12. Ground current vs. temperature (adjustable, $I_{OUT} = 500 \text{ mA}$)

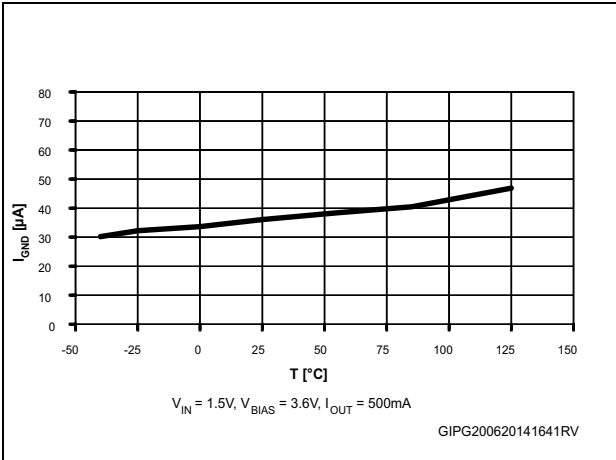


Figure 13. Ground current vs. temperature (adjustable, $I_{OUT} = 800 \text{ mA}$)

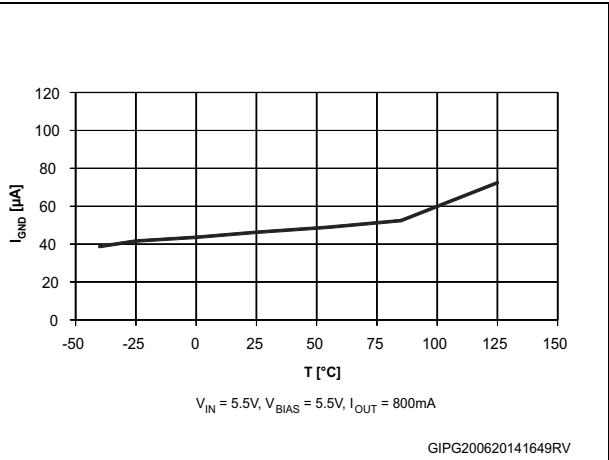


Figure 14. Ground current in off mode vs. temperature (adjustable)

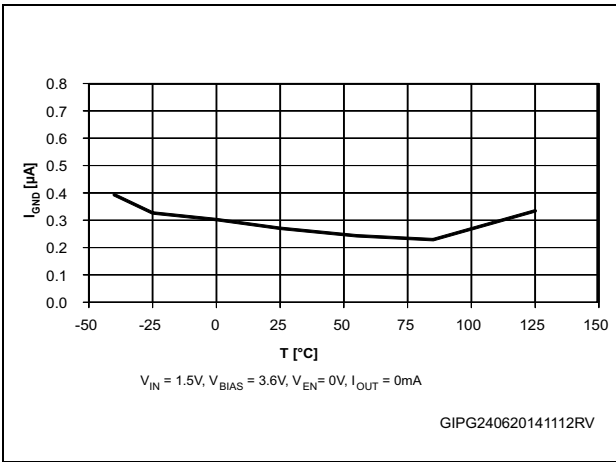


Figure 15. Ground current vs. output current (adjustable)

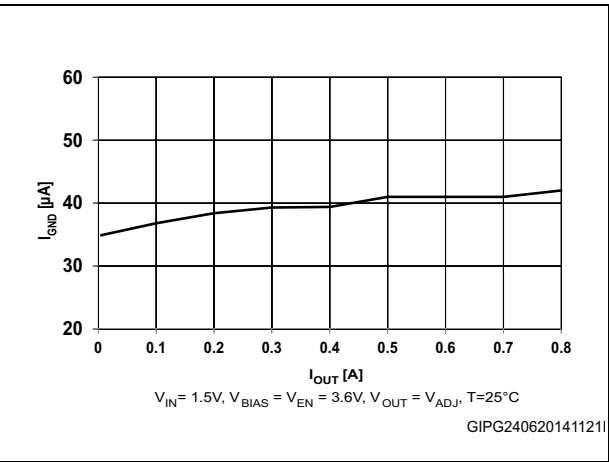


Figure 16. Dropout voltage vs. temperature (adjustable)

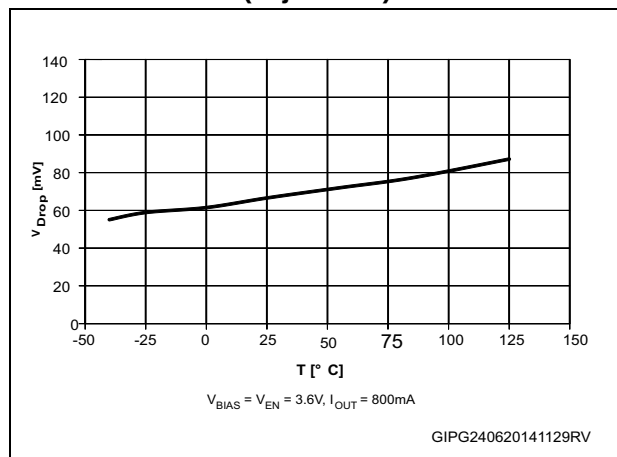


Figure 17. Dropout voltage temperature (fixed 3.3 V)

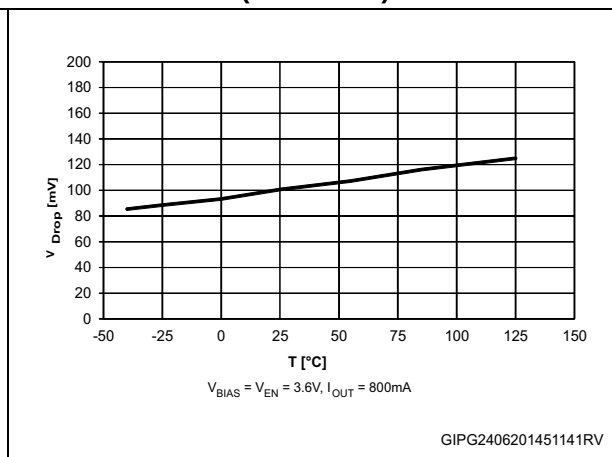


Figure 18. Dropout voltage vs. output current

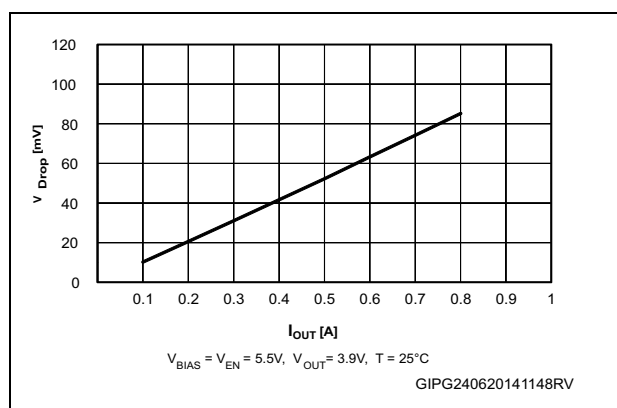


Figure 19. Supply voltage rejection vs. frequency

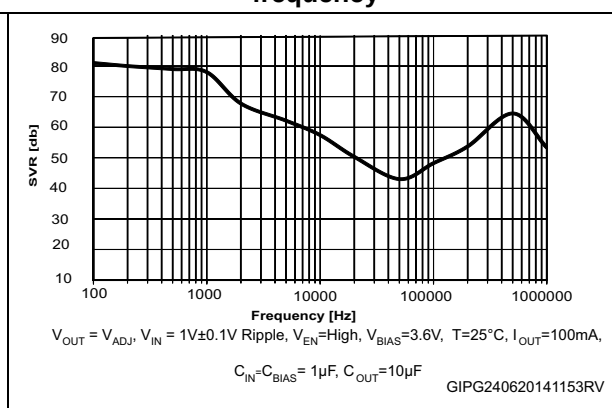


Figure 20. Output noise spectral density

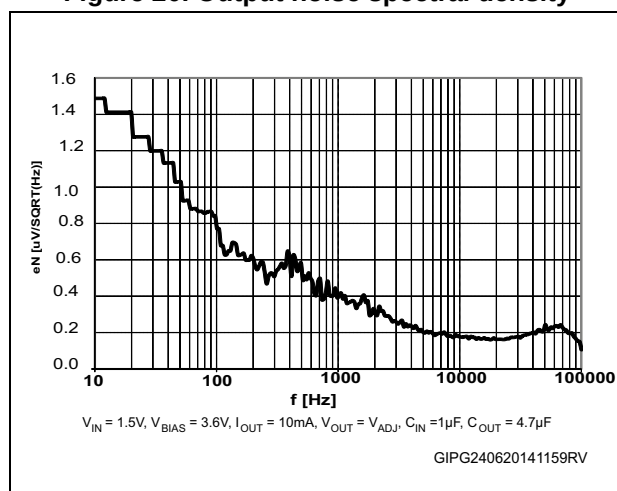
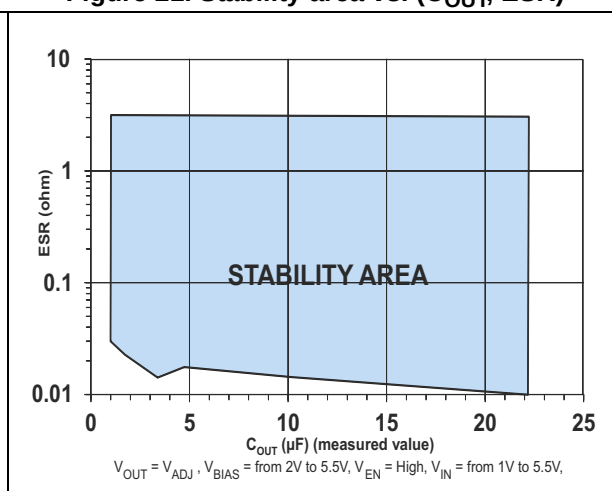
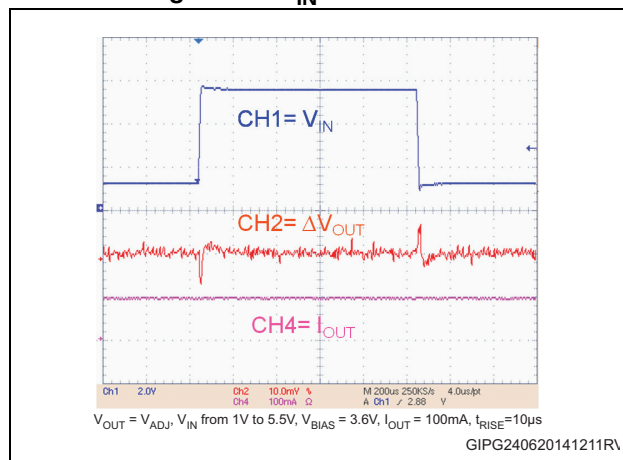
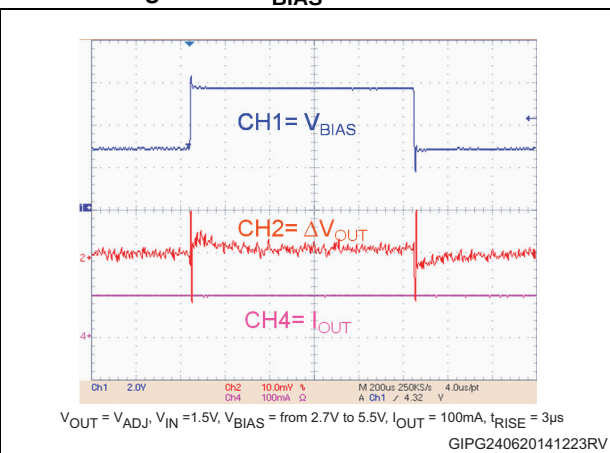
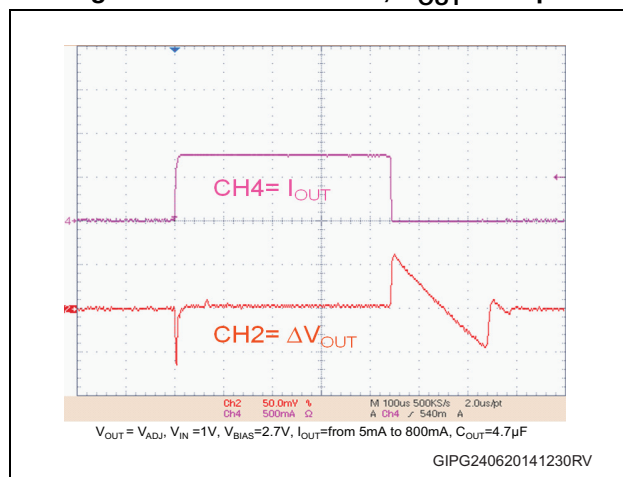
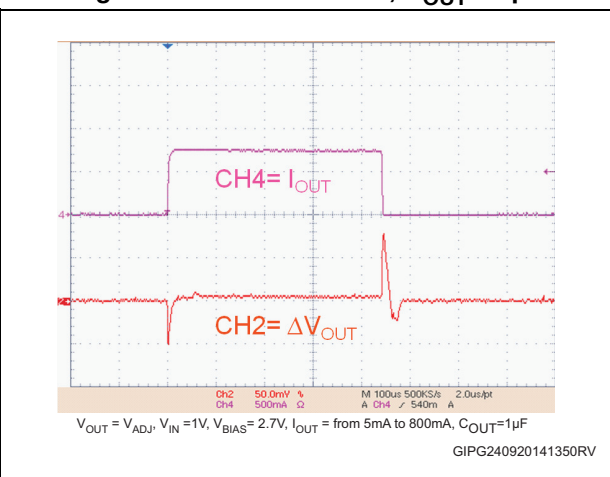
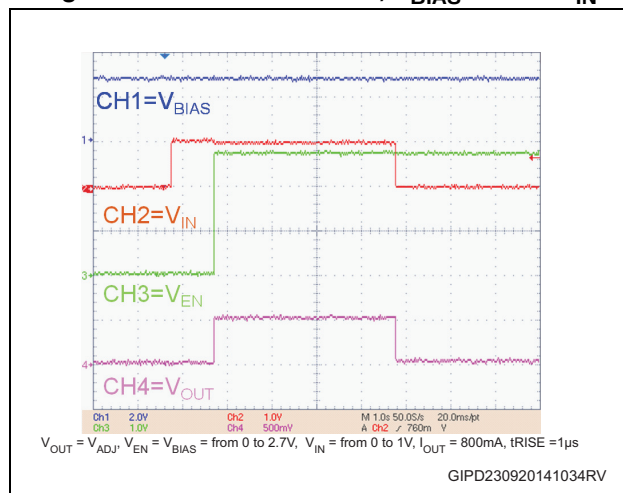
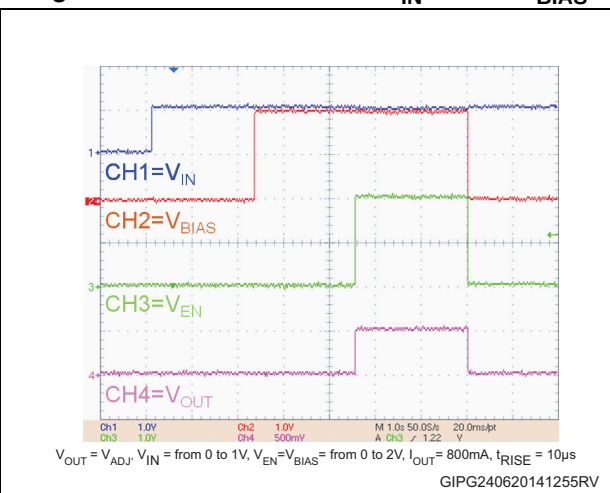
Figure 21. Stability area vs. (C_{OUT} , ESR)

Figure 22. V_{IN} line transientFigure 23. V_{BIAS} line transientFigure 24. Load transient, $C_{OUT} = 4.7 \mu F$ Figure 25. Load transient, $C_{OUT} = 1 \mu F$ Figure 26. Enable transient, V_{BIAS} before V_{IN} Figure 27. Enable transient V_{IN} before V_{BIAS} 

8 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.

Figure 28. DFN8 (2x3 mm) drawings

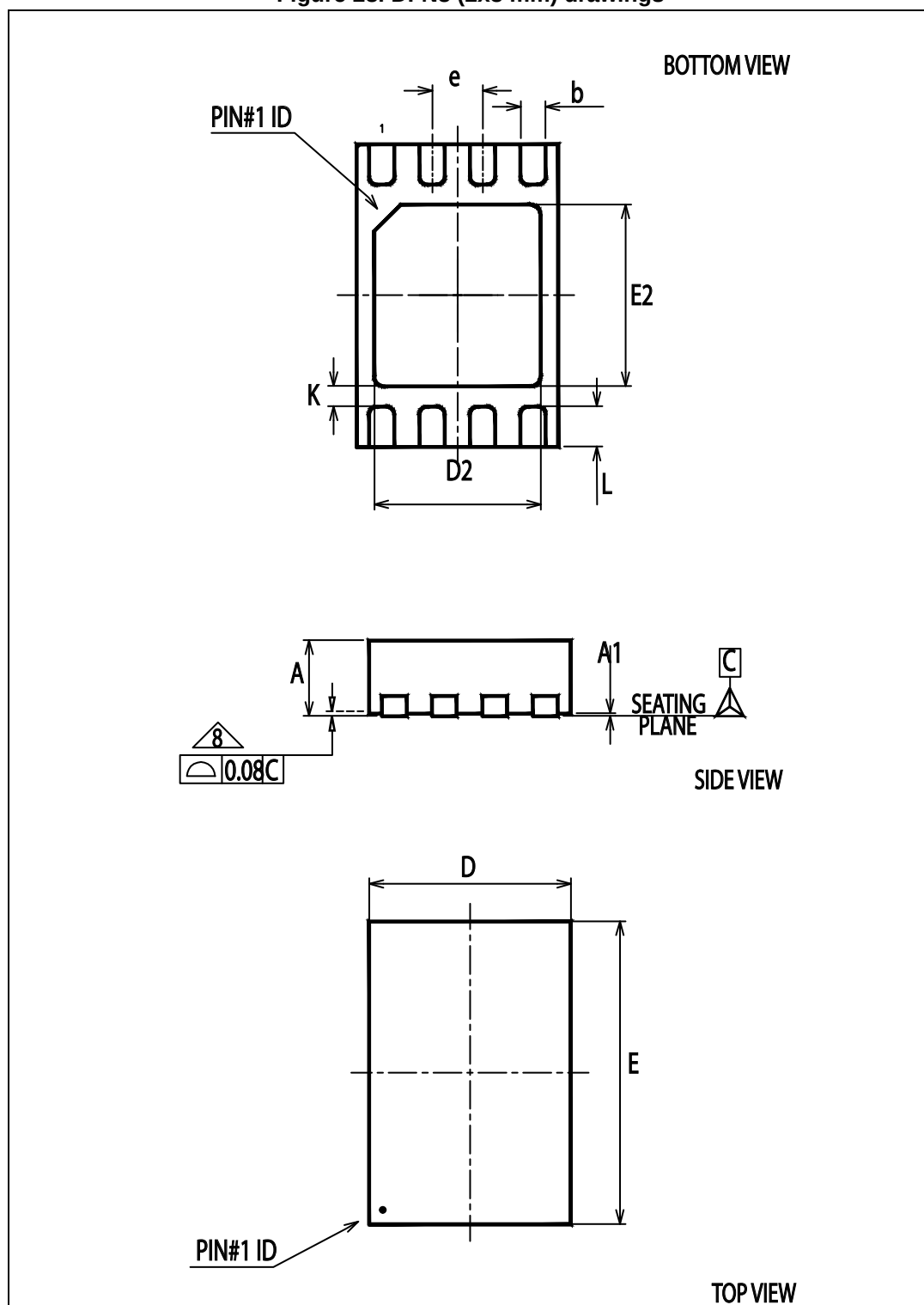
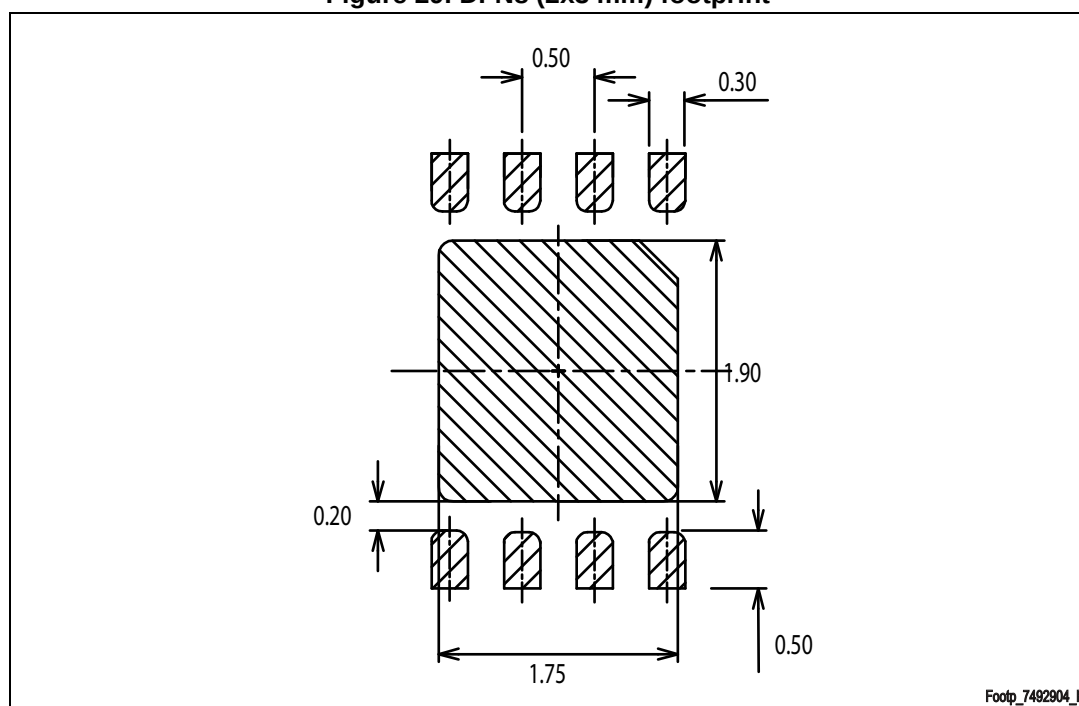


Table 7. DFN8 (2x3 mm) mechanical data

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

Figure 29. DFN8 (2x3 mm) footprint



8.1 Packing mechanical data

Figure 30. Tape for DFN8 (2x3 mm)

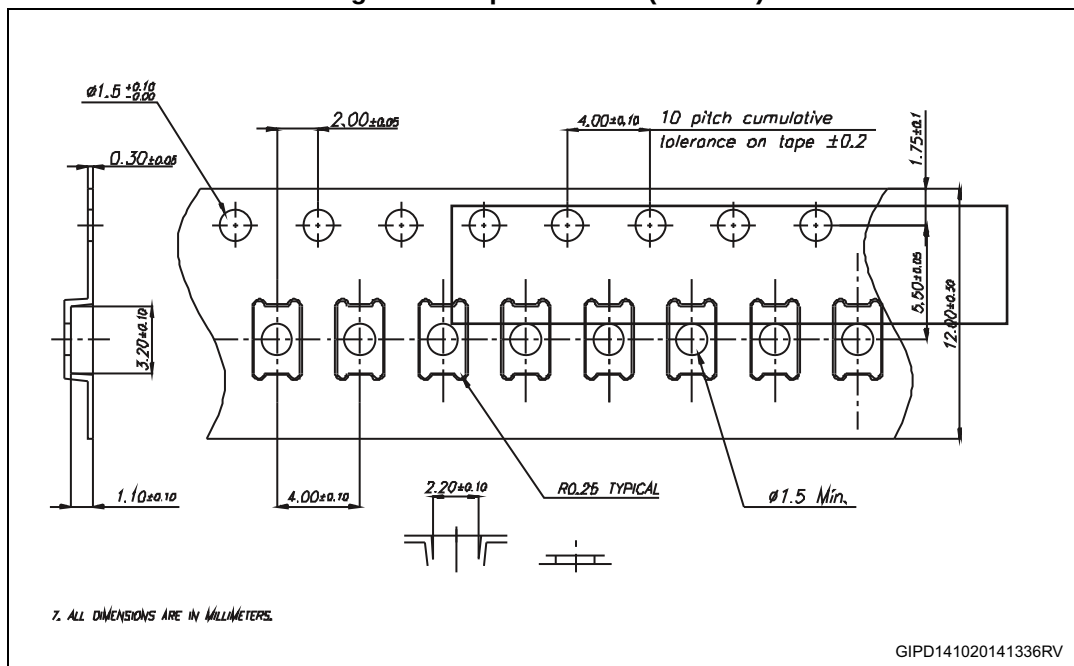


Figure 31. Reel for DFN8 (2x3 mm)

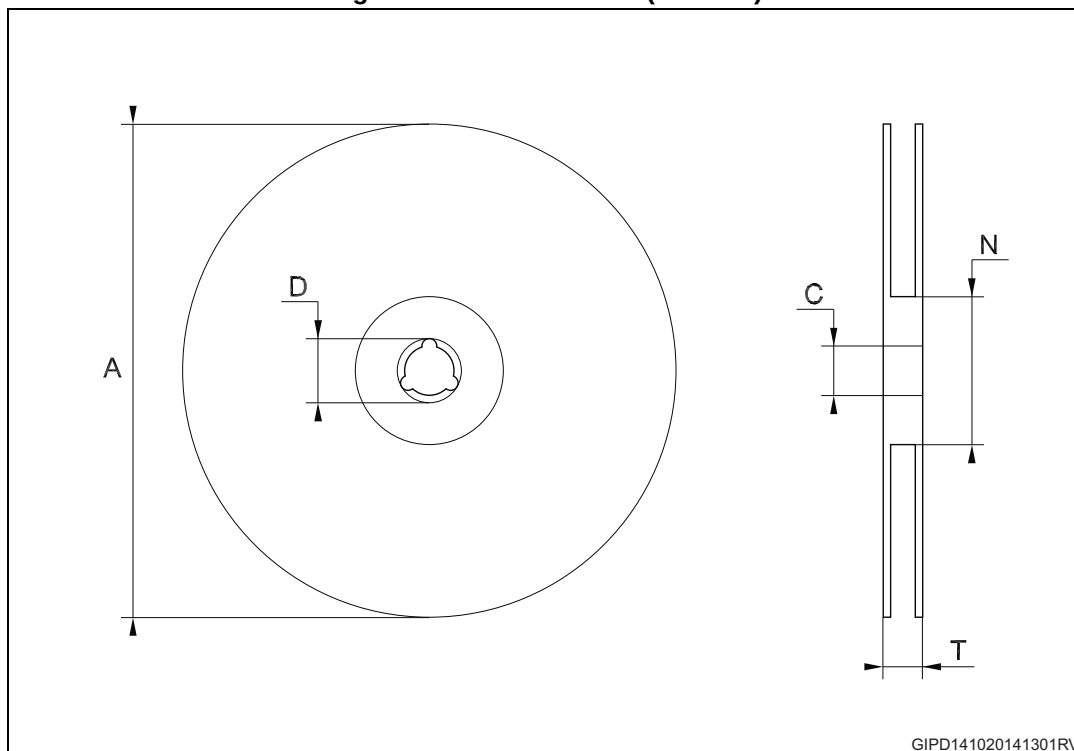


Table 8. DFN8 (2x3 mm) reel mechanical data

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

9 Revision history

Table 9. Document revision history

Date	Revision	Changes
23-Oct-2014	1	First release.

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