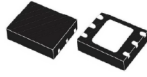


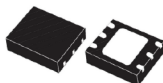
High PSRR, low drop linear regulator IC



SO-8



DFN6 (2x2)



DFN6 (3x3)

Features

- Input voltage from 2.5 V to 18 V
- 20 V AMR
- Any fixed output voltages, from 1.2 V to 12 V in 100 mV steps (from 1.2 V to 6.6 V in 50 mV steps) available on request
- Adjustable version from 1.18 V to $V_{IN} - V_{DROP(MAX)}$
- Guaranteed output current 1.2 A
- Typical dropout 350 mV @ 1.2 A
- Undervoltage lockout
- Enable function
- Internal thermal, current and power limitation
- High PSRR: 87 dB @ 120 Hz, 75 dB @ 1 kHz
- Operating temperature range: -40 °C to 125 °C
- Packages SO-8 batwing plastic micropackage, DFN6 (3x3) and DFN6 (2x2)

Applications

- Consumer
- Industrial
- SMPS
- Point-of-load
- DC-DC post-regulation

Maternity status link

LDL212

Description

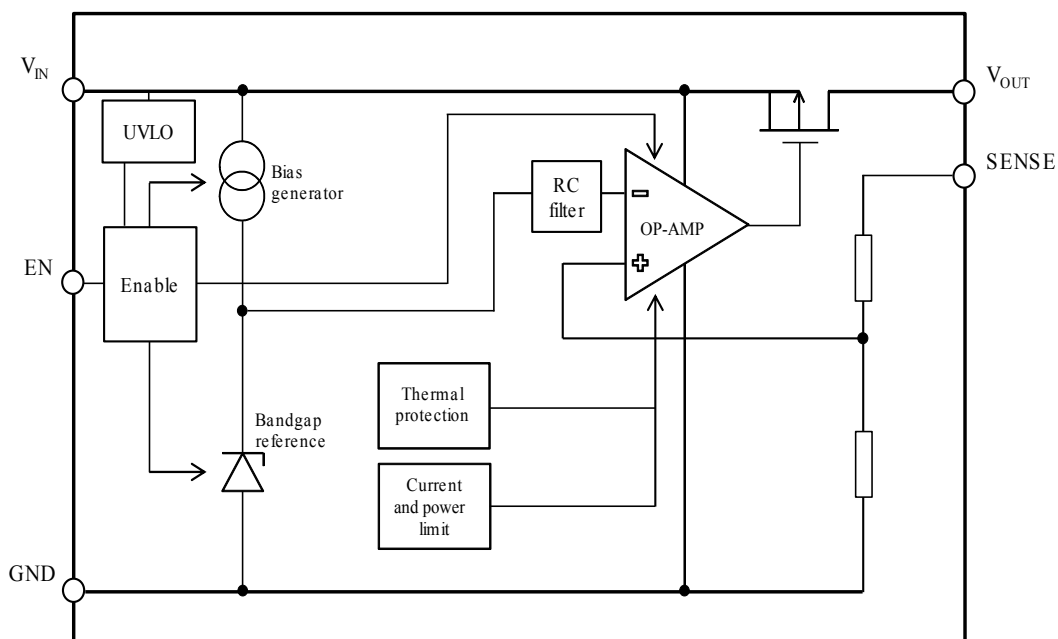
The **LDL212** provides 1.2 A of maximum current from an input voltage range from 2.5 V to 18 V, with a typical dropout voltage of 350 mV @ 1.2 A.

The high power supply rejection ratio of 87 dB at 120 Hz, and more than 40 dB at 100 kHz, makes the **LDL212** suitable for direct regulation in SMPS and secondary linear regulation in DC-DC converters. The **LDL212** goes to shutdown mode due to the enable logic control function, reducing the total current consumption.

The device also includes the current limit, SOA and thermal protections.

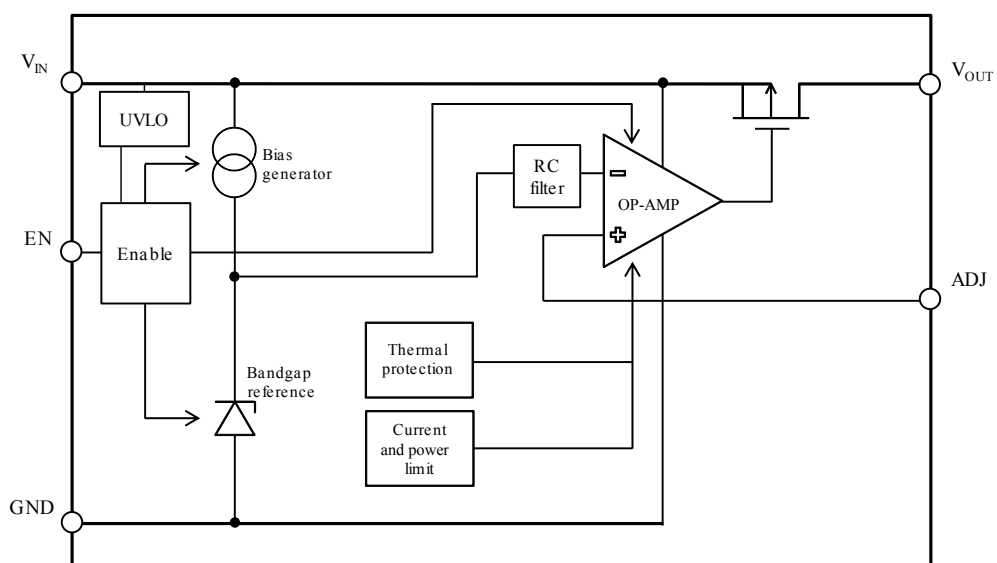
1 Block diagram

Figure 1. Block diagram (fixed)



GIPD251120151438MT

Figure 2. Block diagram (adjustable)



GIPD251120151438bMT

2 Pin configuration

Figure 3. Pin configuration (top view)



GIPD261120151015MT

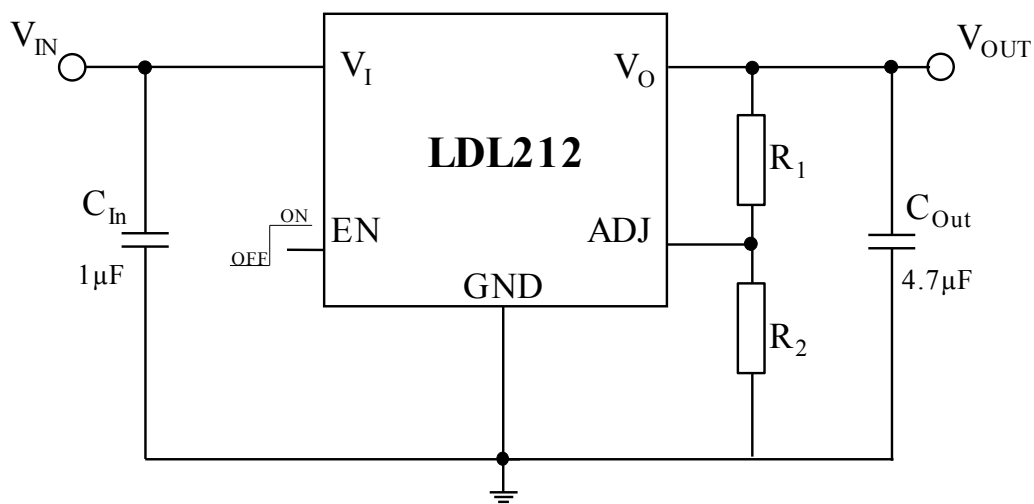
Table 1. Pin description

Pin name	Pin number (SO-8)	Pin number (DFN6)	Description
V_{IN}	4	4	Input voltage
V_{OUT}	1	3	Output voltage
GND	2, 3, 6, 7	1	Ground
ADJ/sense	8	2	Feedback pin for adjustable version / V_{OUT} sense on fixed version
EN	5	6	Enable pin. The device is in off-state when this pin is pulled low
NC	-	5	Not connected
GND	-	exposed pad	Exposed pad must be connected to GND

1. The sense pin on the fixed version must be connected to V_{OUT} for proper operation.

3 Typical application

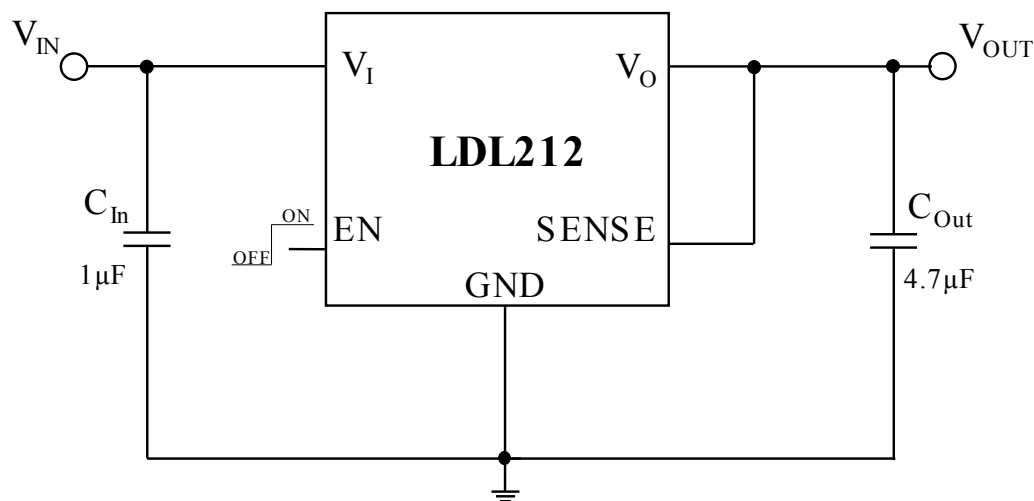
Figure 4. Typical application circuit (adjustable version)



Adjustable version

GIPD011220151346MT

Figure 5. Typical application circuit (fixed version)



Fixed version

GIPD011220151347MT

Note: *R1 and R2 are calculated according to the following formula: $R_1 = R_2 \times (V_{OUT}/V_{ADJ} - 1)$. The output voltage of the adjustable version can be set from 1.18 V to $V_{IN} - V_{DROP(MAX)}$, where $V_{DROP(MAX)}$ is the maximum dropout voltage, as defined in [Table 4. Electrical characteristics](#).*

4 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{IN}	DC input voltage	- 0.3 to 20	V
V_{OUT}	DC output voltage	- 0.3 to $V_{IN} + 0.3$	V
V_{EN}	Enable input voltage	- 0.3 to $V_{IN} + 0.3$	V
V_{SENSE}	Output sense pin voltage	- 0.3 to $V_{IN} + 0.3$	V
V_{ADJ}	ADJ pin voltage	- 0.3 to 2	V
I_{OUT}	Output current	Internally limited	mA
P_D	Power dissipation	Internally limited	mW
T_{STG}	Storage temperature range	- 55 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.*

Table 3. Thermal data

Symbol	Parameter	Value	Unit
SO-8 batwing plastic micropackage	Thermal resistance junction-to-case	20	°C/W
	Thermal resistance junction-to-ambient	55	
DFN6 (2x2)	Thermal resistance junction-to-case	15	
	Thermal resistance junction-to-ambient	65	
DFN6 (3x3)	Thermal resistance junction-to-case	10	
	Thermal resistance junction-to-ambient	55	

5 Electrical characteristics

$T_J = 25\text{ }^{\circ}\text{C}$, $V_{IN} = V_{OUT(NOM)} + 1\text{ V}$, $C_{IN} = 1\text{ }\mu\text{F}$, $C_{OUT} = 4.7\text{ }\mu\text{F}$, $I_{OUT} = 10\text{ mA}$, $V_{EN} = V_{IN}$, unless otherwise specified. (For $V_{OUT(NOM)} \leq 1.5\text{ V}$, $V_{IN} = 2.7\text{ V}$.)

Table 4. Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
V _{IN}	Operating input voltage		2.5		18	V	
V _{UVLO}	Turn-on threshold			2.3	2.4	V	
	Hysteresis			200		mV	
V _{OUT}	V _{OUT} accuracy	I _{OUT} = 10 mA	-2		2	%	
		T _J = 25 °C					
		I _{OUT} = 10 mA	-3		3	%	
		-40 °C < T _J < 125 °C					
V _{ADJ}	Adjustable pin voltage	V _{IN} = 2.5 V, I _{OUT} = 10 mA		1.18		V	
		T _J = 25 °C	-2		+2	%	
		V _{IN} = 2.5 V, I _{OUT} = 10 mA -40 °C < T _J < 125 °C	-3		+3	%	
I _{ADJ}	Adjustable pin current	V _{IN} = 2.5 V, I _{OUT} = 10 mA		20		nA	
ΔV _{OUT}	Line regulation	V _{OUT} + 1 V ≤ V _{IN} ≤ 18 V, I _{OUT} = 10 mA		0.002	0.01	%/V	
ΔV _{OUT}	Load regulation	I _{OUT} = 10 mA to 1.2 A		0.0001	0.0005	%/mA	
V _{DROP}	Dropout voltage ⁽¹⁾	I _{OUT} = 1.2 A V _{OUT} > 3 V		350	600	mV	
	Dropout voltage for SO-8 ⁽¹⁾	-40 °C < T _J < 125 °C			700		
eN	Output noise voltage	10 Hz to 100 kHz, I _{OUT} = 100 mA		60		μV _{RMS} / V _{OUT}	
SVR	Supply voltage rejection	V _{IN} = V _{OUT(NOM)} + 1 V ± V _{RIPPLE}		87		dB	
		V _{RIPPLE} = 0.5 V, f = 120 Hz					
		V _{IN} = V _{OUT(NOM)} + 1 V ± V _{RIPPLE}		75			
		V _{RIPPLE} = 0.5 V, f = 1 kHz					
		V _{IN} = V _{OUT(NOM)} + 1 V ± V _{RIPPLE}		50			
		V _{RIPPLE} = 0.5 V, f = 100 kHz					
I _Q	Quiescent current	I _{OUT} = 0 mA to 1.2 A -40 °C < T _J < 125 °C		250	380	μA	
		V _{IN} input current in OFF mode		0.3	1.5		
		V _{EN} = GND V _{IN} = 18 V					
I _{SC}	Short-circuit current	R _L = 0	1.5	2		A	
V _{EN}	Enable input logic low	V _{IN} = 2.5 V to 18 V -40 °C < T _J < 85 °C			0.4	V	
	Enable input logic high	V _{IN} = 2.5 V to 18 V	1.2				

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{EN}		$-40\text{ }^{\circ}\text{C} < T_J < 85\text{ }^{\circ}\text{C}$				V
I_{EN}	Enable input current			1.5		μA
		$V_{EN} = V_{IN}, V_{IN} = 18\text{ V}$		16	20	
T_{ON}	Turn-on time ⁽²⁾			120		μs
T_{SHDN}	Thermal shutdown			175		$^{\circ}\text{C}$
	Hysteresis			25		

1. Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value. This specification is not valid for output voltages below 2.2 V.
2. Turn-on time is the time measured between the enable input just exceeding V_{EN} high value and the output voltage just reaching 95% of its nominal value.

6 Typical performance characteristics

Figure 6. Output voltage vs. temperature
($V_{IN} = 2.5\text{ V}$, $V_{OUT} = V_{ADJ}$, $I_{OUT} = 0\text{ mA}$)

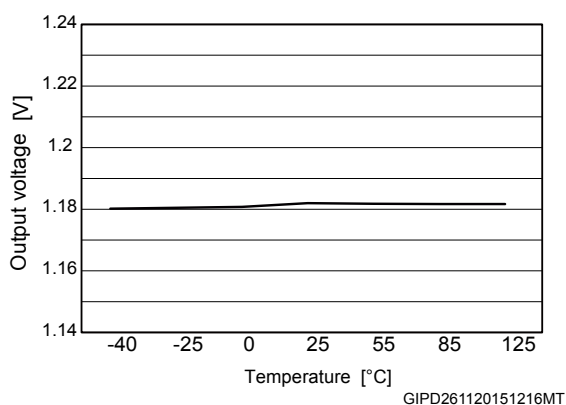


Figure 7. Output voltage vs. temperature
($V_{IN} = 2.5\text{ V}$, $V_{OUT} = V_{ADJ}$, $I_{OUT} = 1200\text{ mA}$)

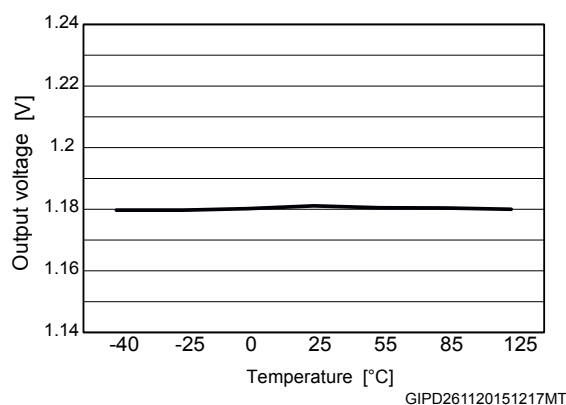


Figure 8. Output voltage vs. temperature ($V_{IN} = 6\text{ V}$, $V_{OUT} = 5\text{ V}$, $I_{OUT} = 10\text{ mA}$)

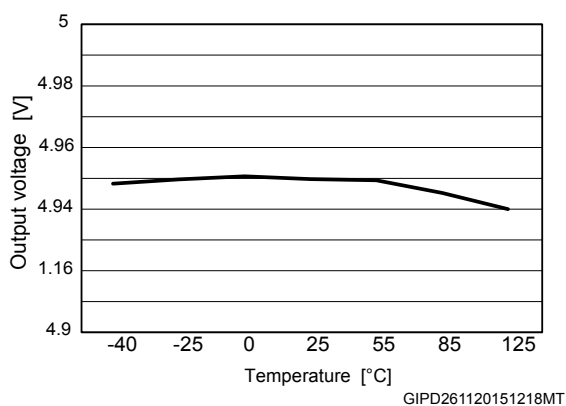


Figure 9. Output voltage vs. temperature ($V_{IN} = 6\text{ V}$, $V_{OUT} = 5\text{ V}$, $I_{OUT} = 1200\text{ mA}$)

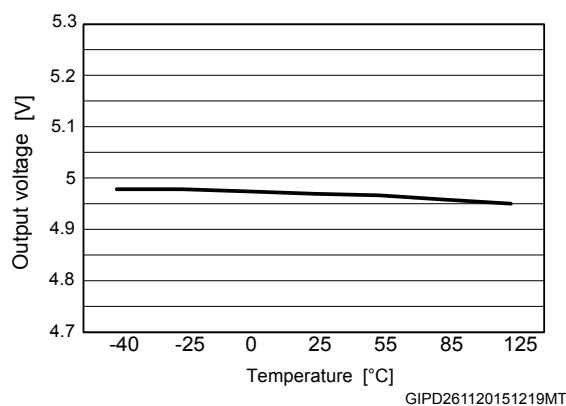


Figure 10. Line regulation vs. temperature ($V_{IN} = 6$ to 18 V, $V_{OUT} = 5$ V, $I_{OUT} = 10$ mA)

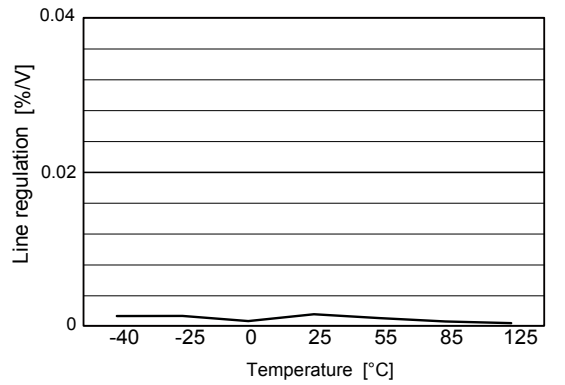


Figure 11. Line regulation vs. temperature ($V_{IN} = 2.5$ to 18 V, $V_{OUT} = V_{ADJ}$, $I_{OUT} = 10$ mA)

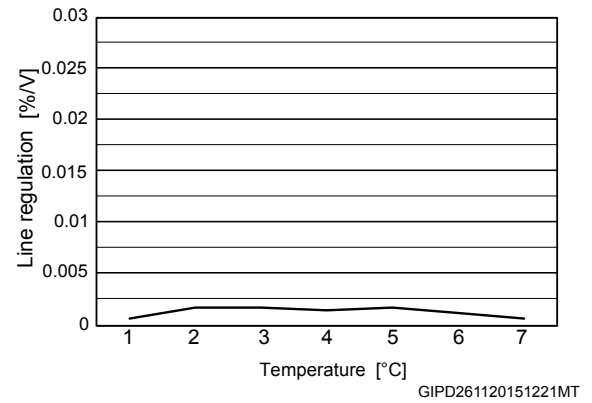


Figure 12. Load regulation vs. temperature ($V_{IN} = 6$ V, $V_{OUT} = 5$ V, $I_{OUT} = 10$ to 1200 mA)

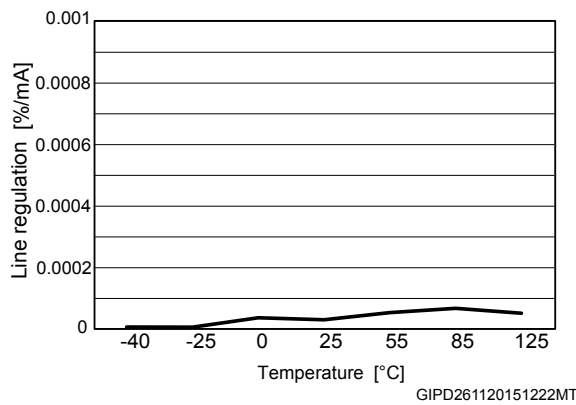


Figure 13. Load regulation vs. temperature ($V_{IN} = 2.5$ V, $V_{OUT} = V_{ADJ}$, $I_{OUT} = 0$ to 1200 mA)

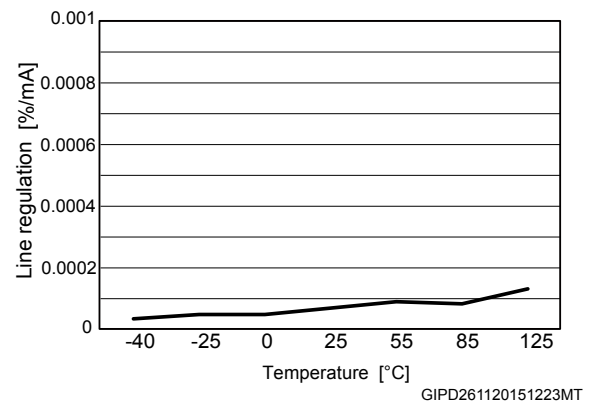


Figure 14. Enable thresholds vs. temperature ($V_{OUT} = V_{ADJ}$)

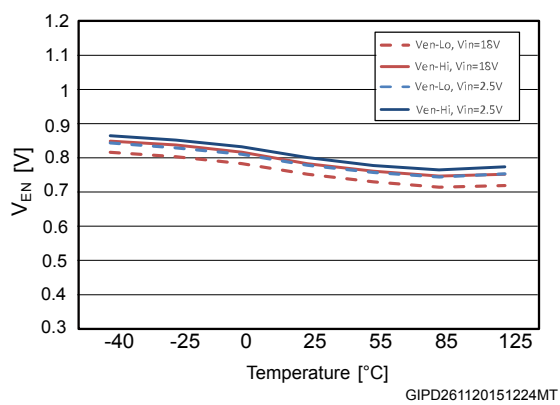


Figure 15. Enable thresholds vs. temperature ($V_{OUT} = 5$ V)

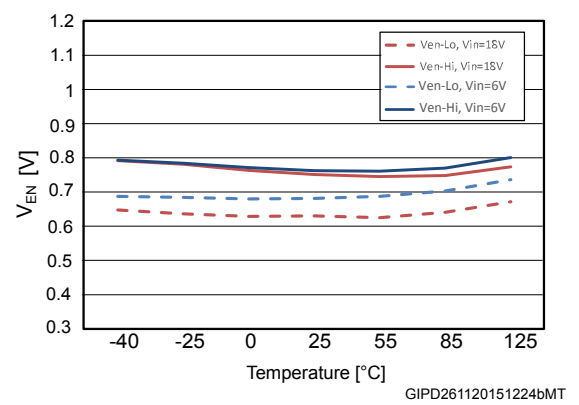
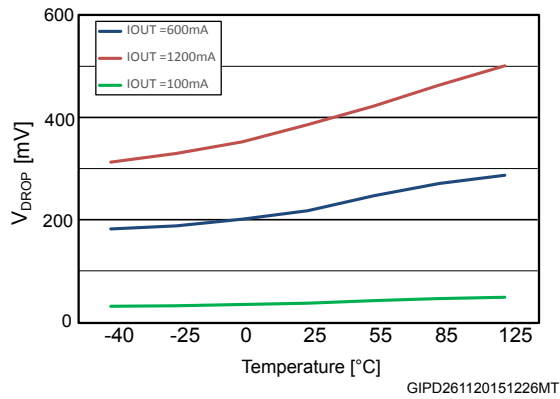
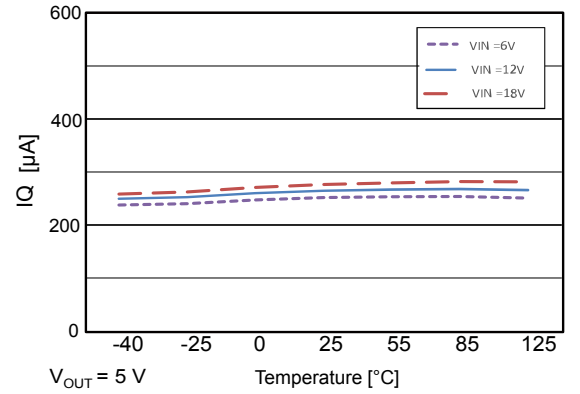
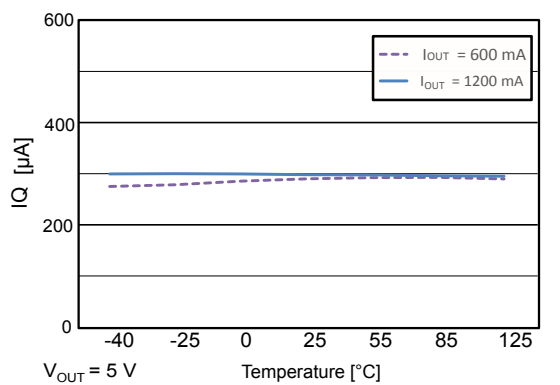


Figure 16. Dropout voltage vs. temperature


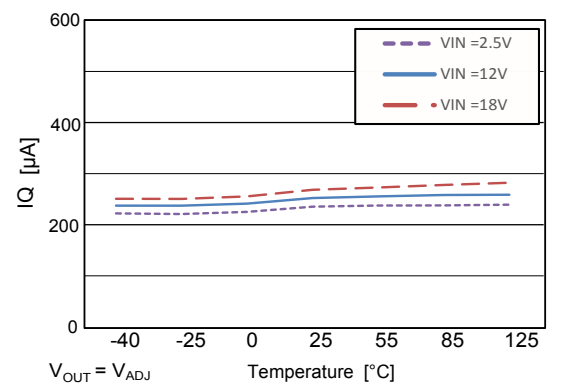
GIPD261120151226MT

Figure 17. Quiescent current vs. temperature ($V_{OUT} = 5\text{ V}$, $I_{OUT} = 0\text{ mA}$)


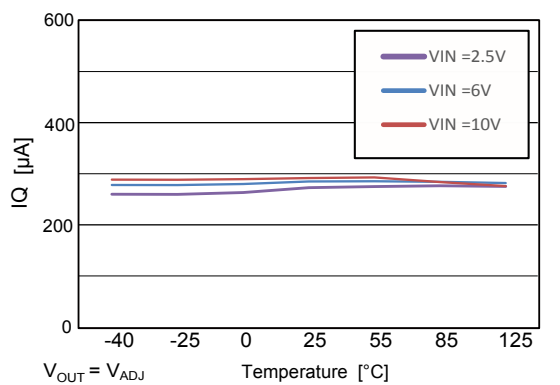
GIPD261120151226bMT

Figure 18. Quiescent current vs. temperature ($V_{OUT} = 5\text{ V}$, $I_{OUT} = 600\text{ mA}$, 1.2 A)


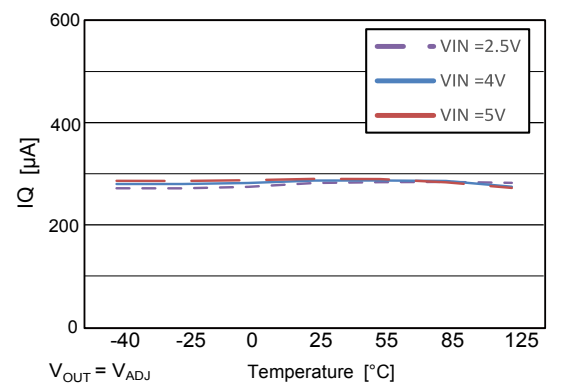
GIPD261120151227MT

Figure 19. Quiescent current vs. temperature ($V_{OUT} = V_{ADJ}$, $I_{OUT} = 0\text{ mA}$)


GIPD261120151228MT

Figure 20. Quiescent current vs. temperature ($V_{OUT} = V_{ADJ}$, $I_{OUT} = 600\text{ mA}$)


GIPD261120151229MT

Figure 21. Quiescent current vs. temperature ($V_{OUT} = V_{ADJ}$, $I_{OUT} = 1.2\text{ A}$)


GIPD261120151230MT

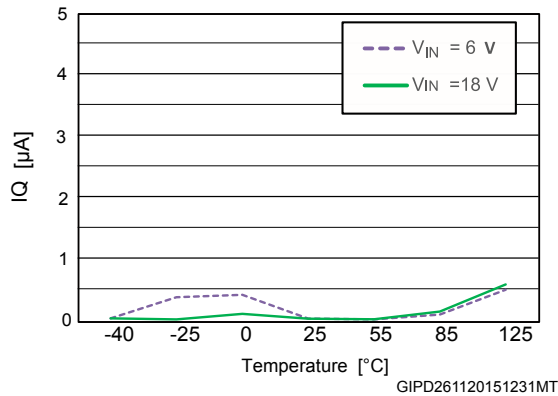
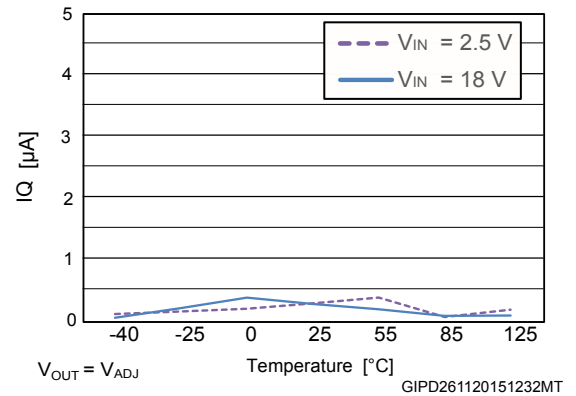
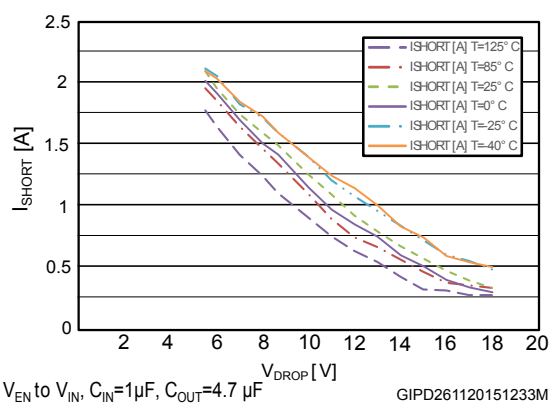
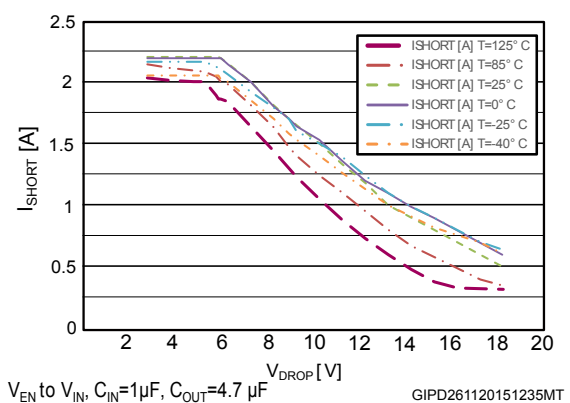
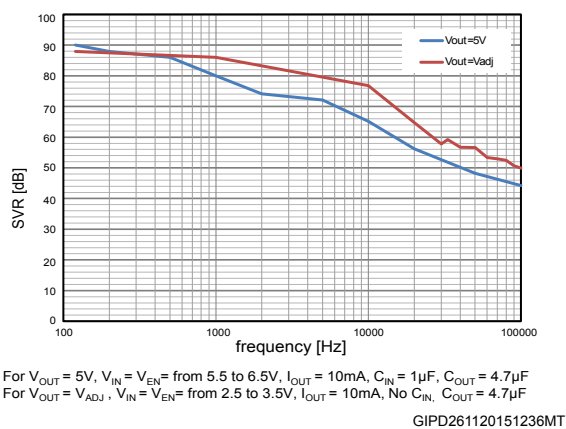
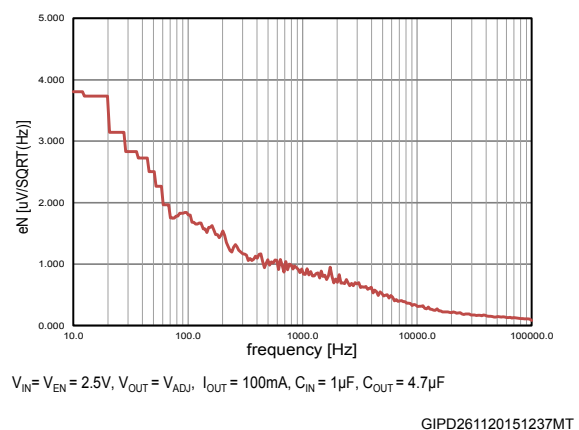
Figure 22. Off-state current vs. temperature
 $(V_{OUT} = 5\text{ V})$

Figure 23. Off-state current vs. temperature
 $(V_{OUT} = V_{ADJ})$

Figure 24. Short-circuit current vs. dropout voltage
 $(V_{OUT} = 5\text{ V})$

Figure 25. Short-circuit current vs. dropout voltage
 $(V_{OUT} = V_{ADJ})$

Figure 26. SVR vs. frequency

Figure 27. Output noise spectral density
 $(V_O = V_{ADJ})$


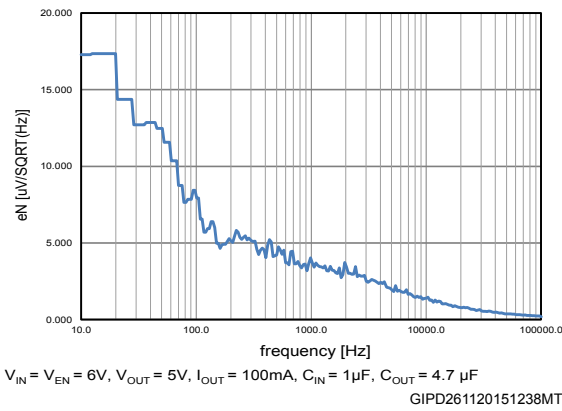
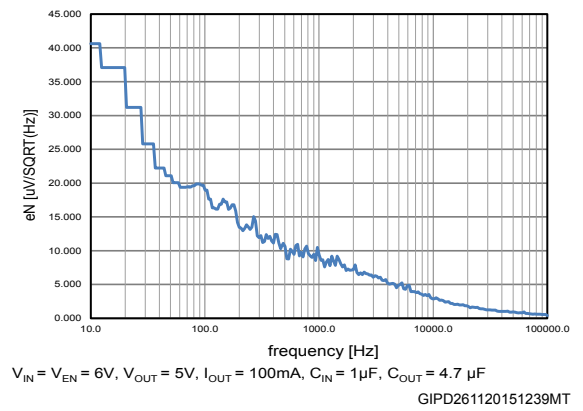
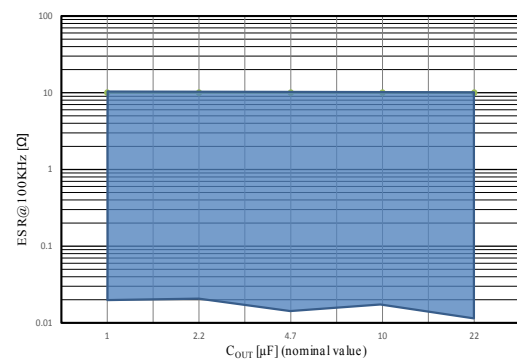
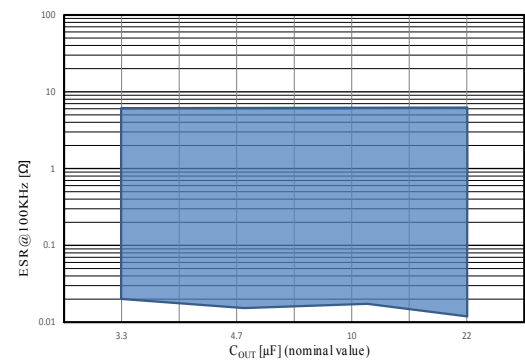
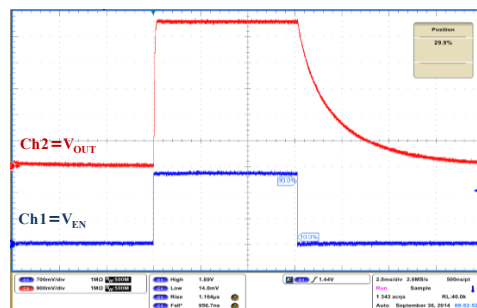
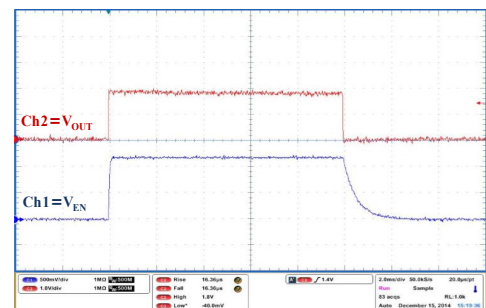
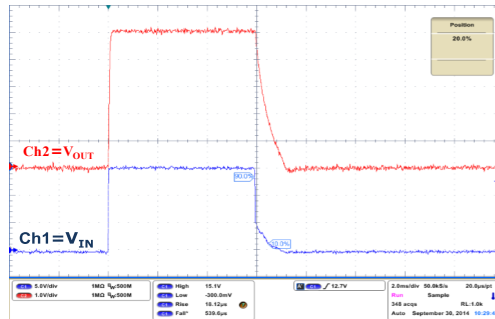
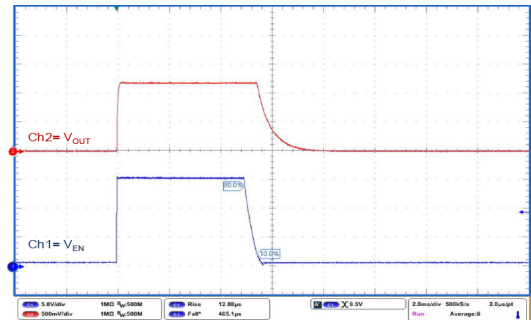
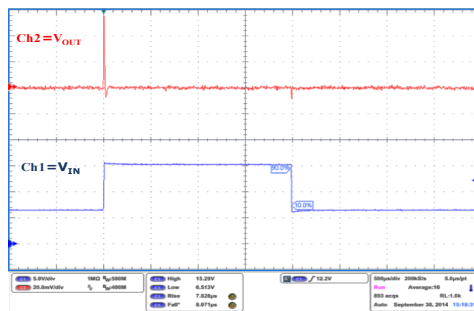
Figure 28. Output noise spectral density ($V_O = 5\text{ V}$)

Figure 29. Output noise spectral density ($V_O = 12\text{ V}$)

Figure 30. Stability plan ($V_{OUT} = 5\text{ V}$)

Figure 31. Stability plan ($V_{OUT} = V_{ADJ}$)

Figure 32. Startup with enable ($V_{OUT} = 5\text{ V}$)

Figure 33. Startup with enable ($V_{OUT} = V_{ADJ}$)


Figure 34. Turn-on time ($V_{OUT} = 5\text{ V}$)

 $V_{EN} = V_{IN}$ = from 0 to 15 V, $I_{OUT} = 10\text{ mA}$, $C_{OUT} = 1\text{ }\mu\text{F}$, $T_{rise} = 10\text{ }\mu\text{s}$

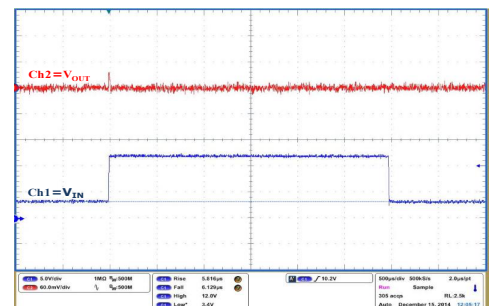
GIPD301120151407MT

Figure 35. Turn-on time ($V_{OUT} = V_{ADJ}$)

 $V_{EN} = V_{IN}$ = from 0 to 15 V, $I_{OUT} = 10\text{ mA}$, $C_{IN} = 1\text{ }\mu\text{F}$, $C_{OUT} = 4.7\text{ }\mu\text{F}$, $t_{rise} = 10\text{ }\mu\text{s}$

GIPD301120151408MT

Figure 36. Line transient ($V_{OUT} = 5\text{ V}$)

 V_{IN} = from 6 to 15 V, $I_{OUT} = 10\text{ mA}$, $C_{OUT} = 4.7\text{ }\mu\text{F}$, $t_r = 5\text{ }\mu\text{s}$

GIPD301120151409MT

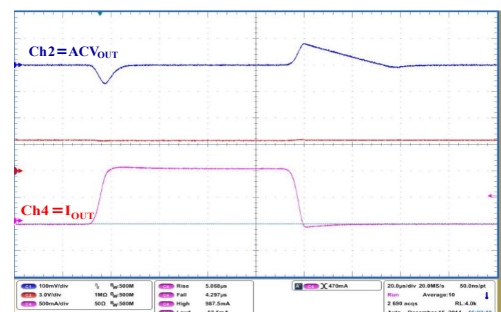
Figure 37. Line transient ($V_{OUT} = V_{ADJ}$)

 V_{IN} = from 3.5 to 15 V, $I_{OUT} = 10\text{ mA}$, NO C_{IN} , $C_{OUT} = 4.7\text{ }\mu\text{F}$, $t_r = 5\text{ }\mu\text{s}$

GIPD301120151410MT

Figure 38. Load transient ($V_{OUT} = 5\text{ V}$)

 V_{EN} to V_{CC} , $V_{IN} = 6\text{ V}$, I_{OUT} = from 10 mA to 1.2 A, $C_{IN} = 1\text{ }\mu\text{F}$, $C_{OUT} = 4.7\text{ }\mu\text{F}$, $T_{rise} = 5\text{ }\mu\text{s}$

GIPD301120151411MT

Figure 39. Load transient ($V_{OUT} = V_{ADJ}$)

 V_{EN} to V_{CC} , $V_{IN} = 3.5\text{ V}$, I_{OUT} = from 10 mA to 1.2 A, $C_{IN} = 1\text{ }\mu\text{F}$, $C_{OUT} = 4.7\text{ }\mu\text{F}$, $T_{rise} = 5\text{ }\mu\text{s}$

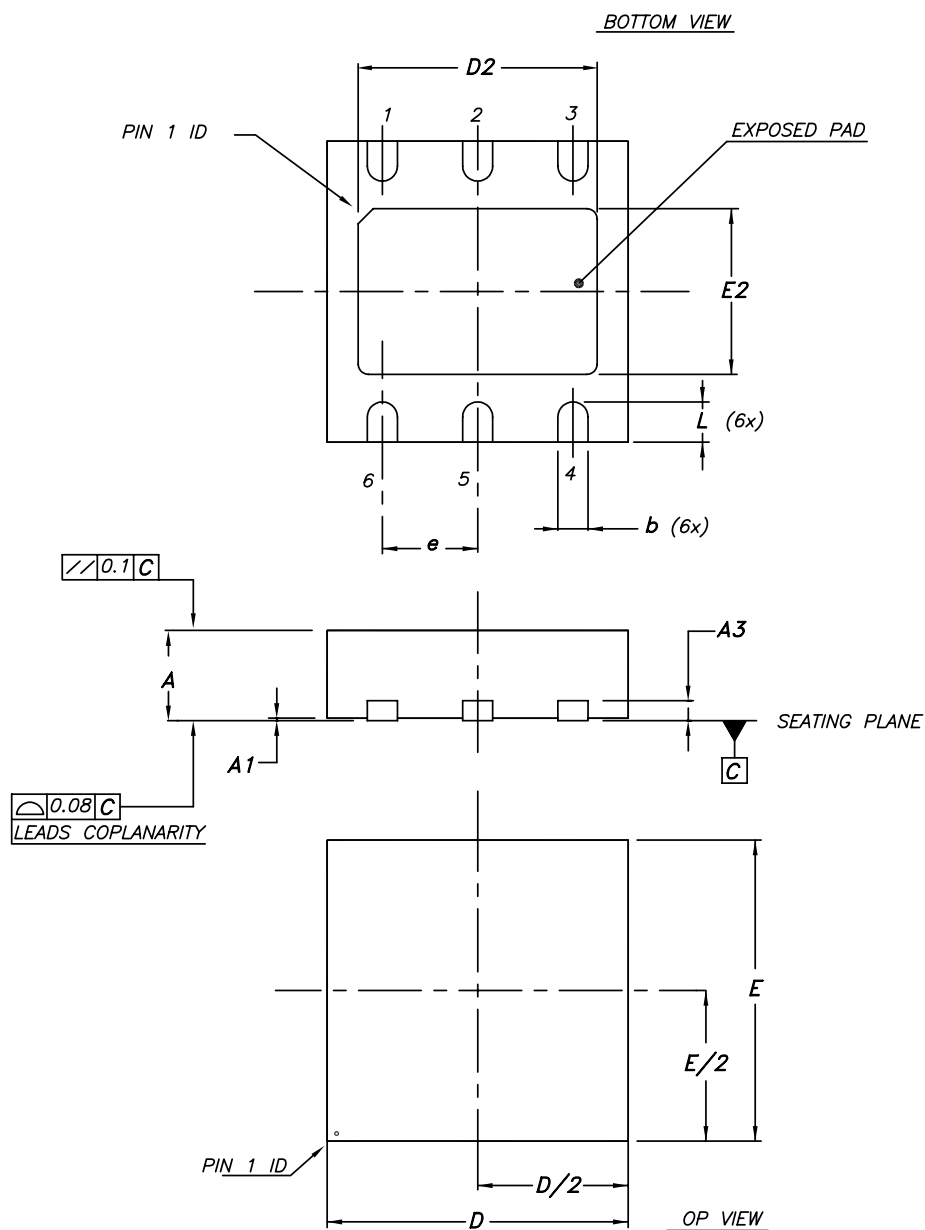
GIPD301120151412MT

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.

7.1 DFN6 (3x3) package information

Figure 40. DFN6 (3x3) package outline



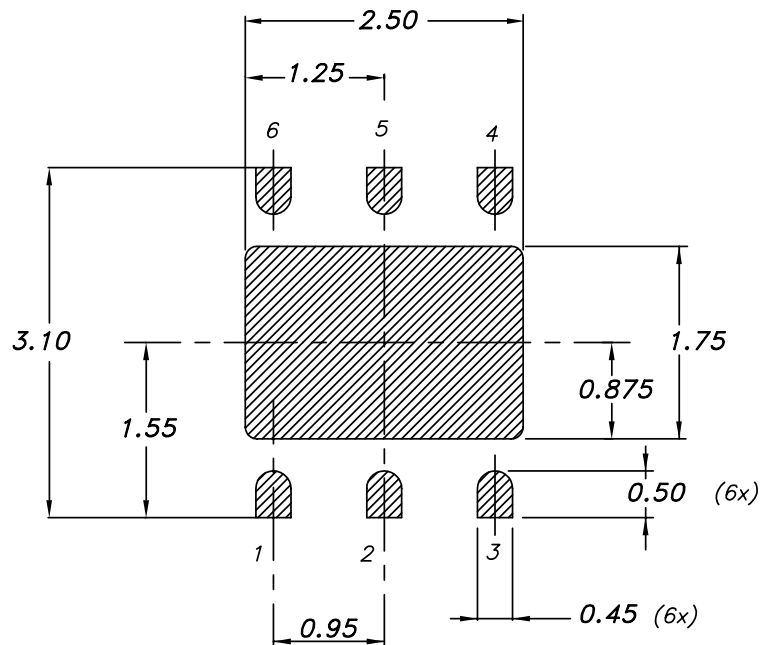
7946637_C

Table 5. DFN6 (3x3) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1
A1	0	0.02	0.05
A3		0.20	
b	0.23		0.45
D	2.90	3	3.10
D2	2.23		2.50
E	2.90	3	3.10
E2	1.50		1.75
e		0.95	
L	0.30	0.40	0.50

Figure 41. DFN6 (3x3) recommended footprint

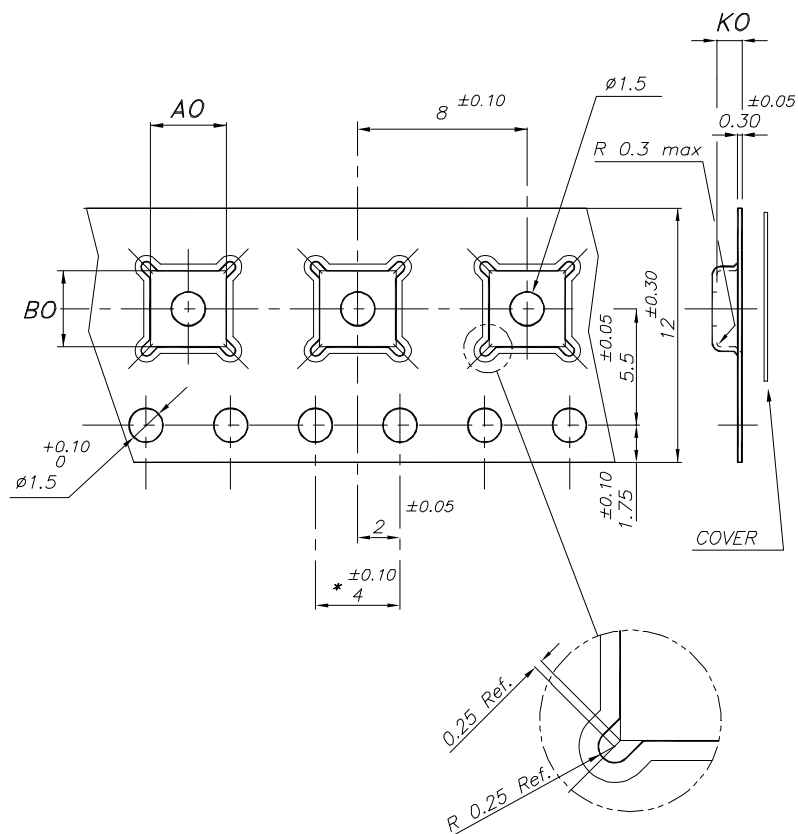
FOOTPRINT RECOMMENDED



7946637_C

7.2

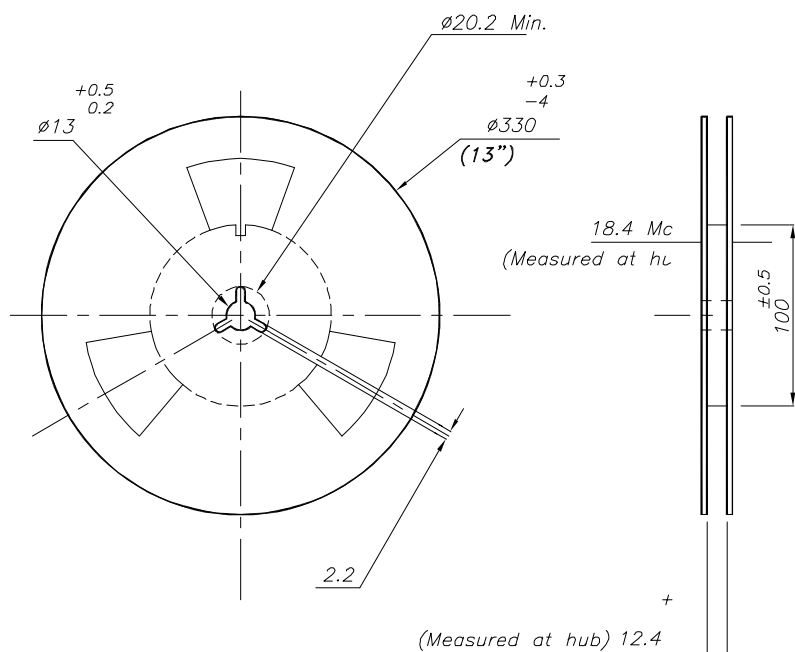
Figure 42. DFN6 (3x3) tape outline



*
- 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ± 0.20

7875978 N

Figure 43. DFN6 (3x3) reel outline



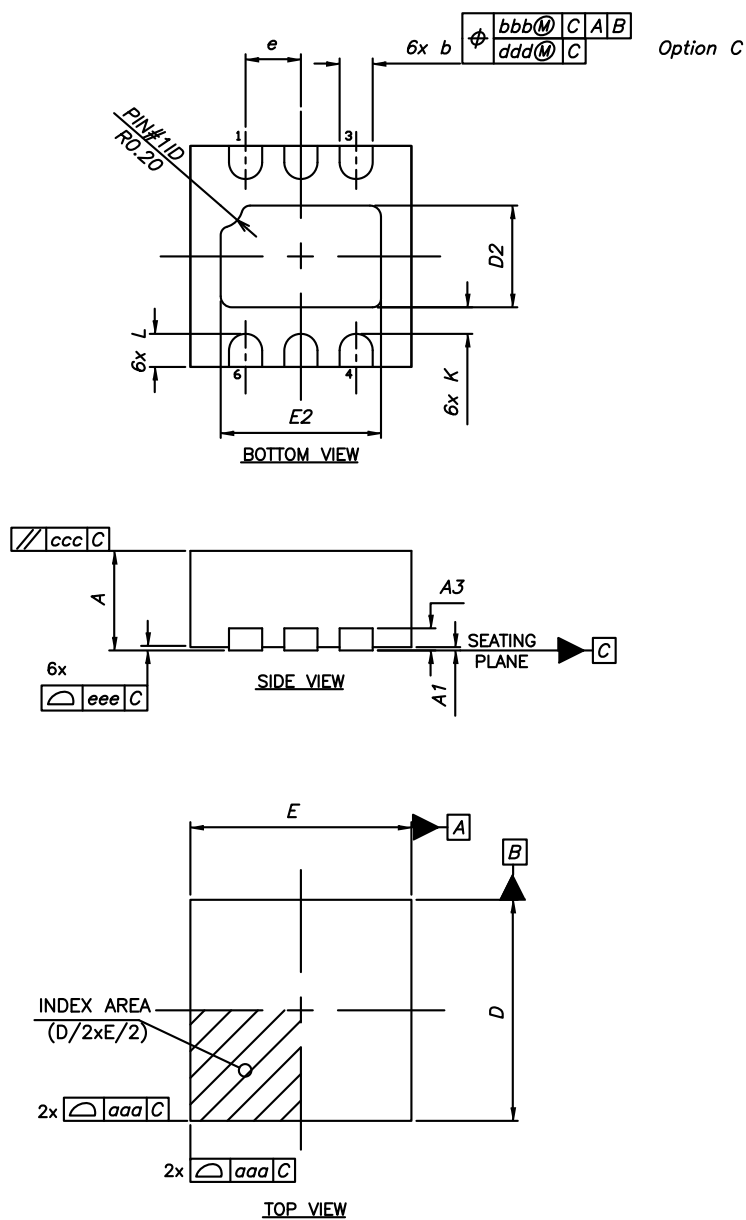
7875978_N

Table 6. DFN6 (3x3) tape and reel mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A0	3.20	3.30	3.40
B0	3.20	3.30	3.40
K0	1	1.10	1.20

7.3 DFN6 (2x2) package information

Figure 44. DFN6 (2x2) package outline

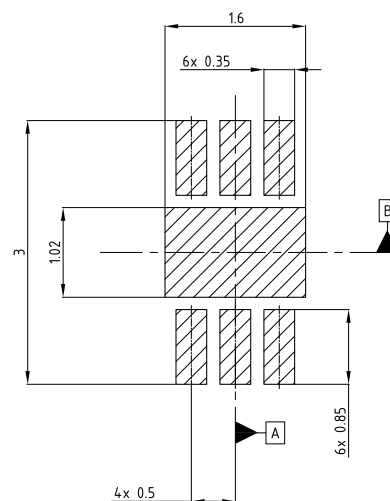


7733060

Table 7. DFN6 (2x2) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3	-	0.203 ref	-
b	0.25	0.30	0.35
D	-	2.00	-
E	-	2.00	-
e	-	0.50	-
D2	0.77	0.92	1.02
E2	1.30	1.45	1.55
K	0.15	-	-
L	0.20	0.30	0.40
aaa	-	0.05	-
bbb	-	0.10	-
ccc	-	0.10	-
ddd	-	0.05	-
eee	-	0.08	-

Figure 45. DFN6 (2x2) recommended footprint



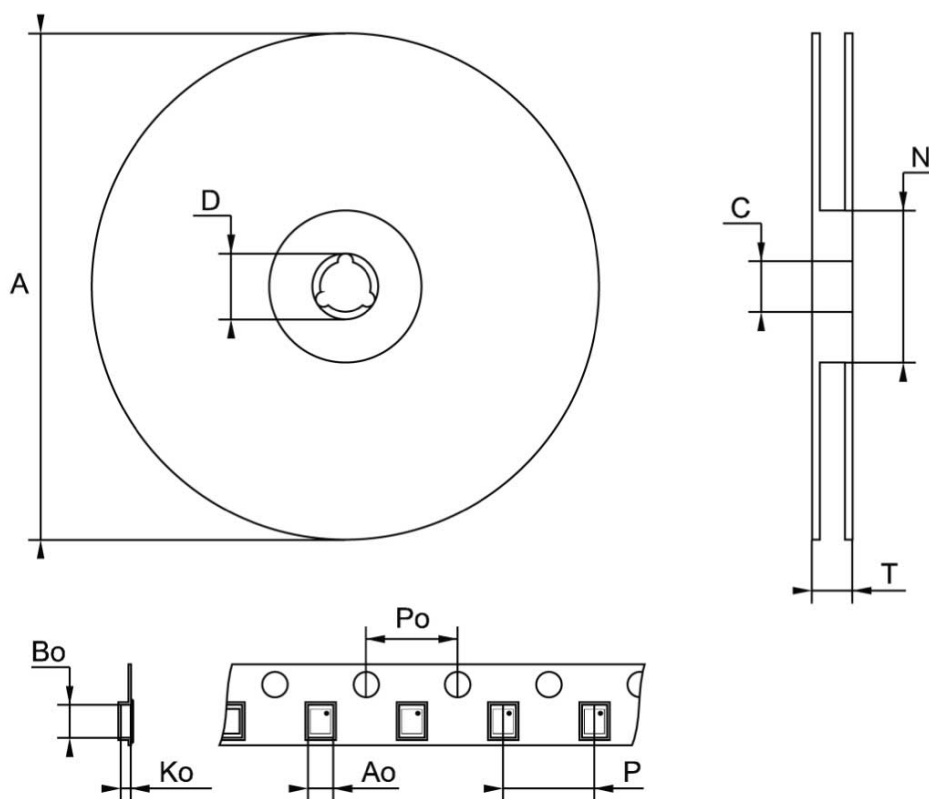
Notes:

- 1) This footprint is able to ensure insulation up to 32 Vrms (according to CEI IEC 664-1)
- 2) The device must be positioned within $\oplus 0.02$ A B

7733060 revE

7.4 DFN6 (2x2) packing information

Figure 46. DFN6 (2 x 2 mm) reel outline



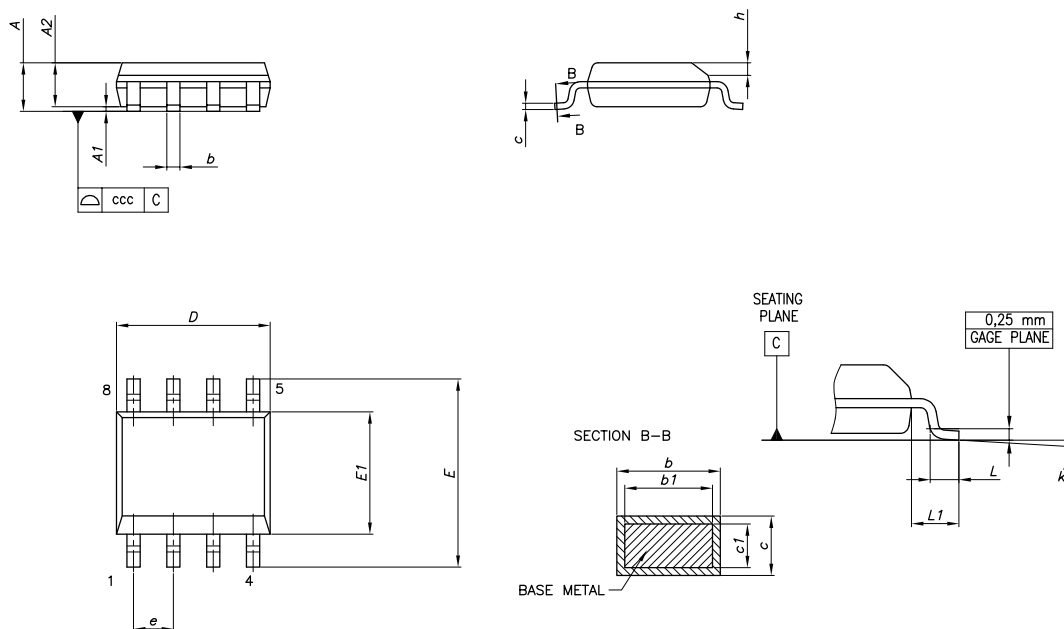
Note: Drawing not in scale

Table 8. 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	

7.5 SO8 package information

Figure 47. SO-8 batwing package outline

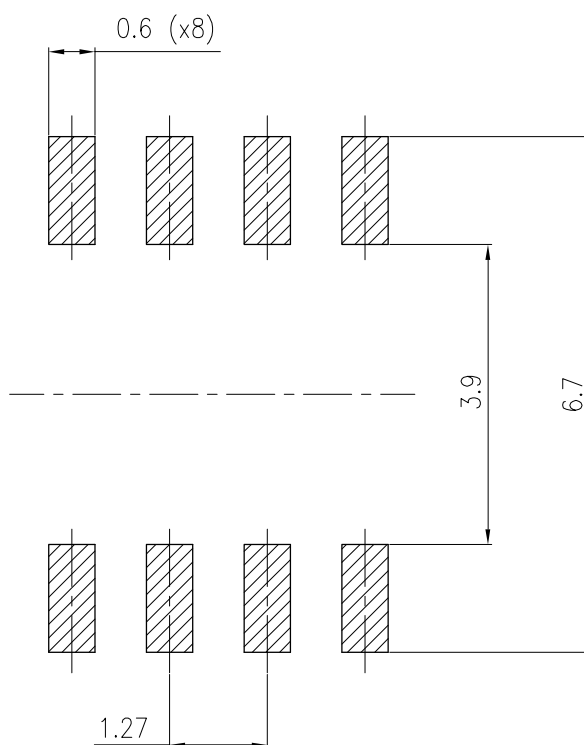


0016023_G

Table 9. SO-8 batwing mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			1.75
A1	0.10		0.25
A2	1.25		
b	0.31		0.51
b1	0.28		0.48
c	0.10		0.25
c1	0.10		0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e		1.27	
h	0.25		0.50
L	0.40		1.27
L1		1.04	
L2		0.25	
k	0°		8°
ccc			0.10

Figure 48. SO-8 batwing recommended footprint



0016023_GU

8 Ordering information

Table 10. Order code

DFN6 (3x3)	DFN6 (2x2)	SO-8 batwing plastic micropackage	Output voltage (V)
LDL212PU12R ⁽¹⁾			1.2
LDL212PU15R			1.5
LDL212PU18R ⁽¹⁾			1.8
LDL212PU25R ⁽¹⁾			2.5
LDL212PU30R ⁽¹⁾			3
	LDL212PV33R	LDL212D33R	3.3
LDL212PU50R			5
LDL212PUR	LDL212PVR	LDL212DR	Adjustable

1. Available on request.

Revision history

Table 11. Document revision history

Date	Revision	Changes
02-Mar-2016	1	Initial release.
19-Sep-2016	2	Updated Table 3: "Thermal data" and Section 5: "Electrical characteristics". Minor text changes.
17-Sep-2018	3	Added: GND pin name in Table 1. Pin description and new order code LDL212D33R in Table 10. Order code.
16-Apr-2019	4	In Table 10. Order code, in LDL2012D33R the note has been removed. Updated GND description in Table 1. Pin description.
21-Feb-2020	5	Added dropout voltage for SO-8 in Table 4. Electrical characteristics .

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