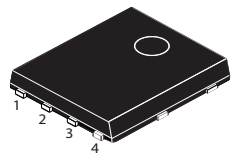
STL60N10F7

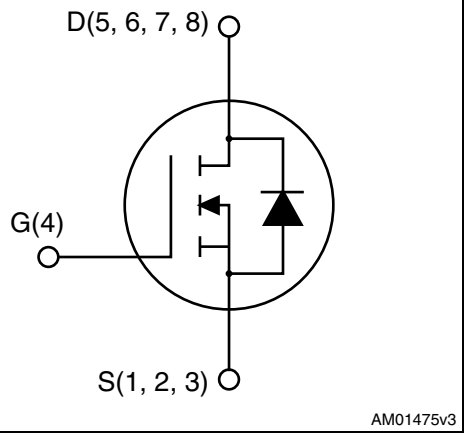
N-channel 100 V, 0.0145 Ω typ., 12 A, STripFET™ VII DeepGATE™ Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet - production data



PowerFLAT™ 5x6

Figure 1. Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max	I_D	P_{TOT}
STL60N10F7	100 V	0.018 Ω	12 A	5 W

- Ultra low on-resistance
- 100% avalanche tested

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the 7th generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest $R_{DS(on)}$ in all packages.

Table 1. Device summary

Order code	Marking	Package	Packaging
STL60N10F7	60N10F7	PowerFLAT™ 5x6	Tape and reel

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	100	V
V_{GS}	Gate-source voltage	20	V
I_D (1)	Drain current (continuous) at T_C = 25 °C	46	A
I_D (1)	Drain current (continuous) at T_C = 100 °C	33	A
I_D (2)	Drain current (continuous) at T_{pcb} = 25 °C	12	A
I_D (2)	Drain current (continuous) at T_{pcb} =100 °C	9	A
I_{DM} (2)(3)	Drain current (pulsed)	48	A
P_{TOT} (1)	Total dissipation at T_c = 25 °C	72	W
P_{TOT} (2)	Total dissipation at T_{pcb} = 25 °C	5	W
T_J	Operating junction temperature	-55 to 175	°C
T_{stg}	Storage temperature		°C

1. This value is rated according to $R_{thj\text{-}c}$.
2. This value is rated according to $R_{thj\text{-}pcb}$.
3. Pulse width limited by safe operating area.

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb	31	°C/W
$R_{thj\text{-}c}$	Thermal resistance junction-case	2.08	°C/W

1. When mounted on FR-4 board of 1inch², 2oz Cu, t < 10 sec

2 Electrical characteristics

(T_{CASE}=25 °C unless otherwise specified)

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage (V_{GS}= 0)	I_D = 1 mA	100	-		V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 100 V V_{DS} = 100 V; T_C=125 °C		-	1 100	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = 20 V		-	100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS}= V_{GS}, I_D = 250 µA	2.5		4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS}= 10 V, I_D= 6 A		0.0145	0.018	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} =50 V, f=1 MHz, V_{GS}=0	-	1640	-	pF
C_{oss}	Output capacitance		-	360	-	pF
C_{rss}	Reverse transfer capacitance		-	25	-	pF
Q_g	Total gate charge	V_{DD}=50 V, I_D = 12 A V_{GS} =10 V *Figure 14*	-	25	-	nC
Q_{gs}	Gate-source charge		-	12	-	nC
Q_{gd}	Gate-drain charge		-	5	-	nC
Q_{oss}	Output charge	V_{DD}=40 V, V_{GS}=0V	-	28	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD}=50 V, I_D= 6 A, R_G=4.7 Ω, V_{GS}= 10 V *Figure 13*	-	15	-	ns
t_r	Rise time		-	17	-	ns
$t_{d(off)}$	Turn-off delay time		-	24	-	ns
t_f	Fall time		-	8	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current		-		12	A
I_{SDM} (1)	Source-drain current (pulsed)		-		48	A
V_{SD} (2)	Forward on voltage	I_{SD} = 12 A, V_{GS}=0	-		1.1	V
t_{rr}	Reverse recovery time	I_{SD} = 12 A, di/dt = 100 A/µs, V_{DD}=50 V, T_j=150 °C	-	53		ns
Q_{rr}	Reverse recovery charge		-	67		nC
I_{RRM}	Reverse recovery current		-	2.5		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300 µs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

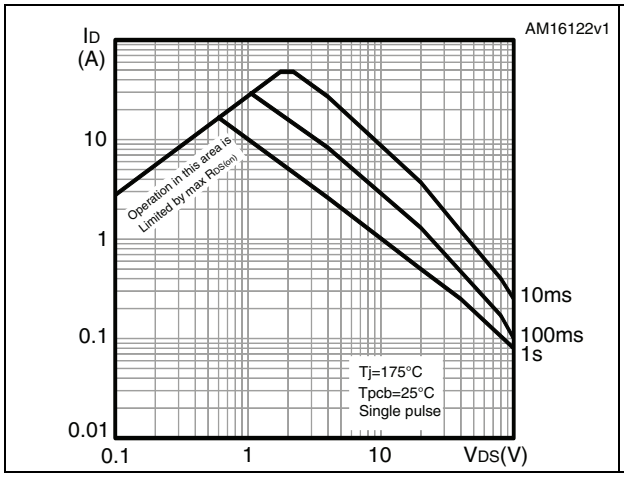


Figure 3. Thermal impedance

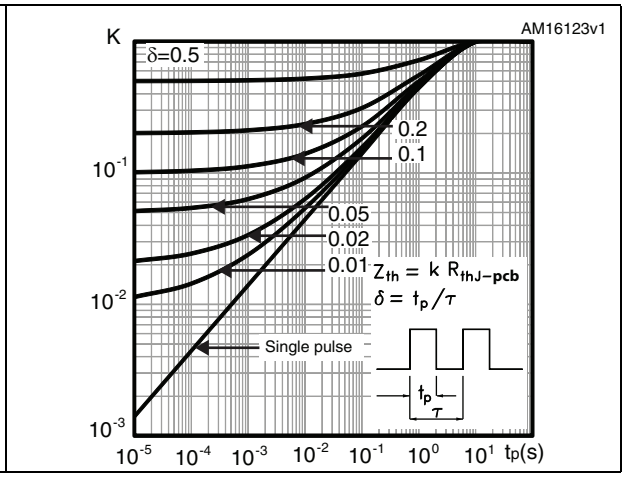


Figure 4. Output characteristics

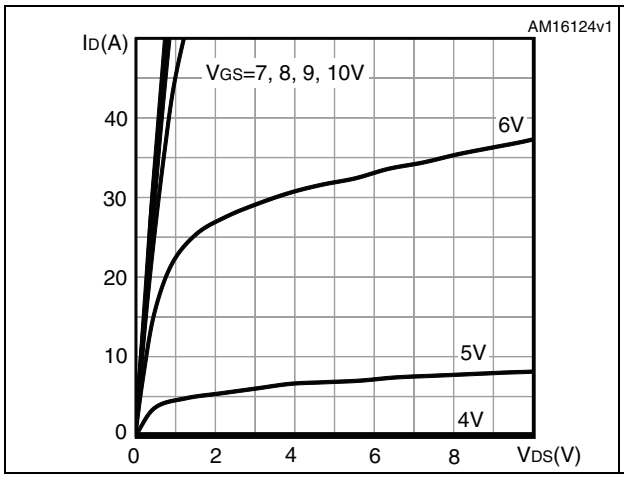


Figure 5. Transfer characteristics

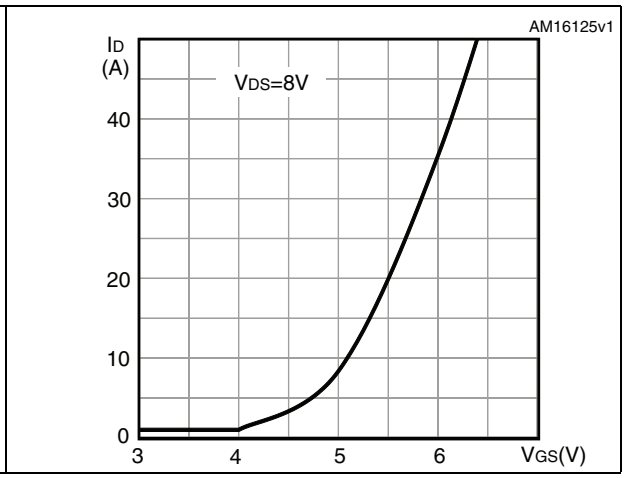


Figure 6. Gate charge vs gate-source voltage

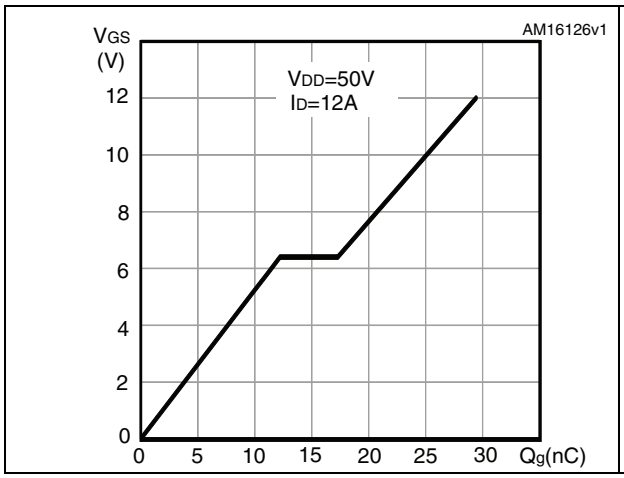


Figure 7. Static drain-source on-resistance

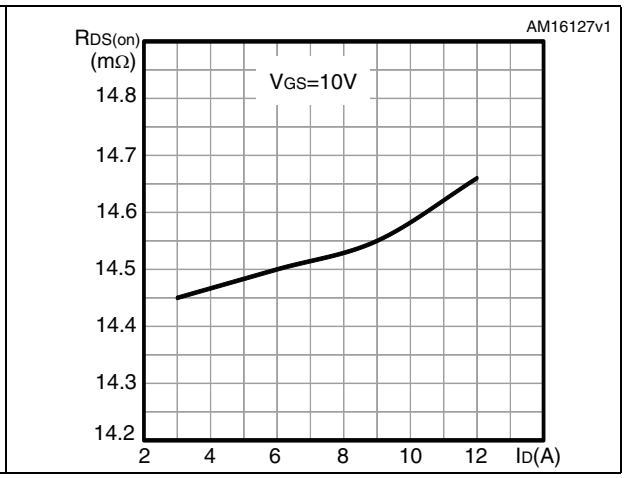


Figure 8. Capacitance variations

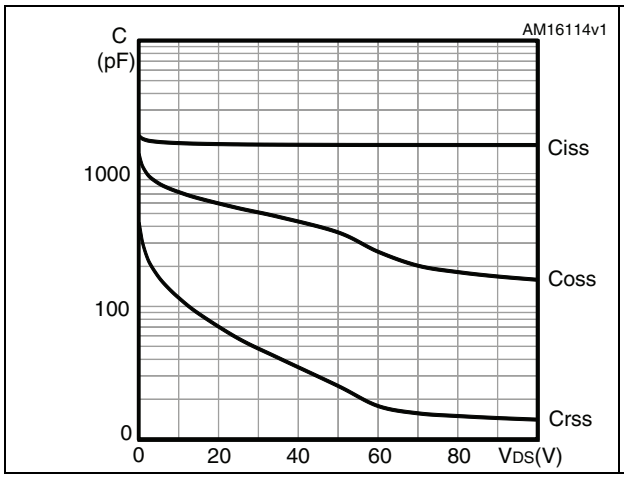


Figure 9. Normalized gate threshold voltage vs temperature

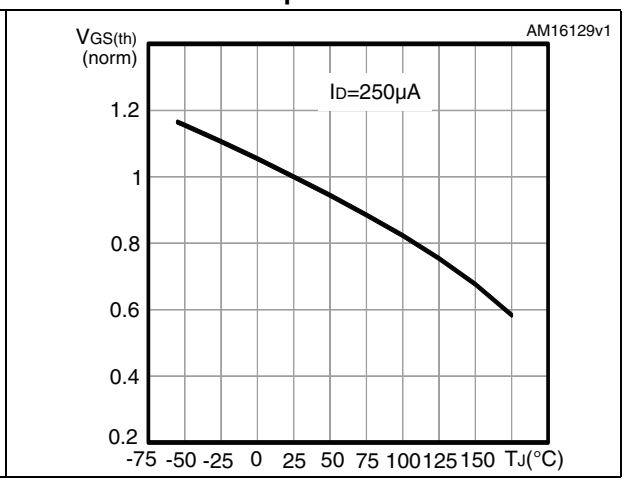


Figure 10. Normalized on-resistance vs temperature

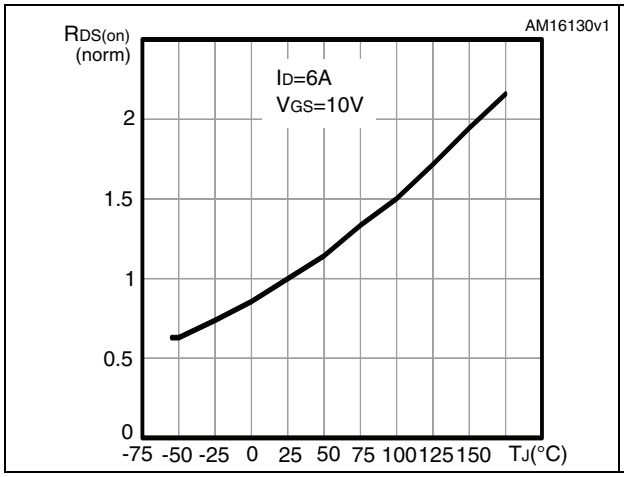


Figure 11. Source-drain diode forward characteristics

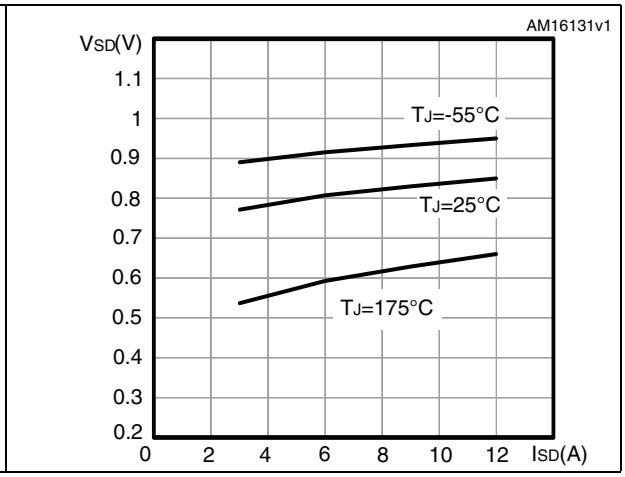
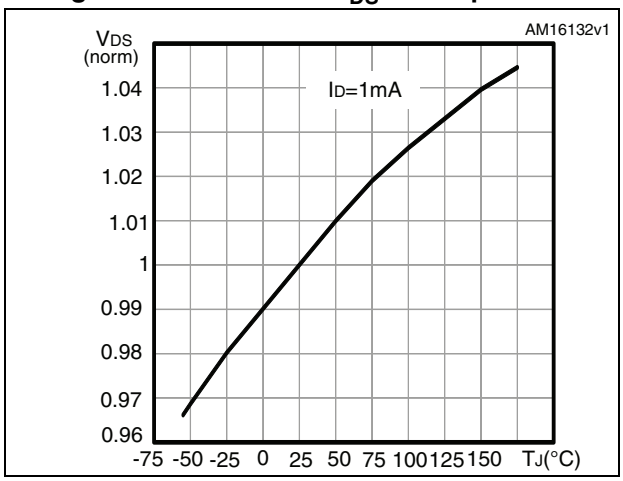


Figure 12. Normalized V_{DS} vs temperature



3 Test circuits

Figure 13. Switching times test circuit for resistive load

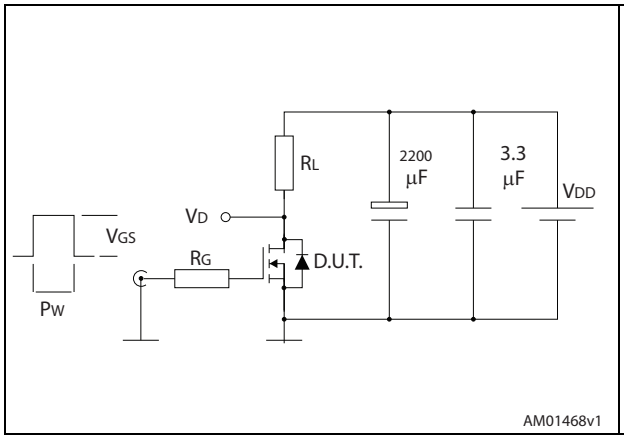


Figure 14. Gate charge test circuit

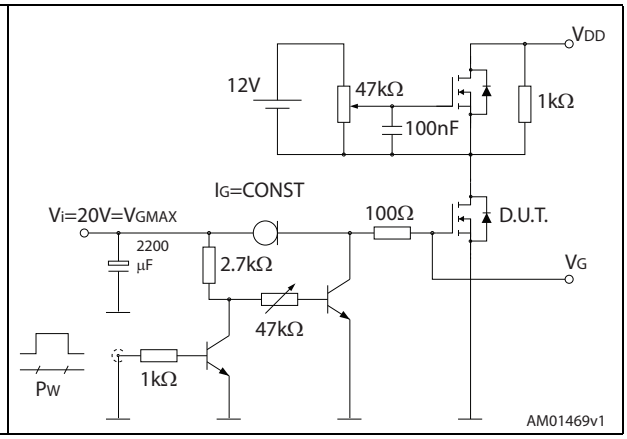


Figure 15. Test circuit for inductive load switching and diode recovery times

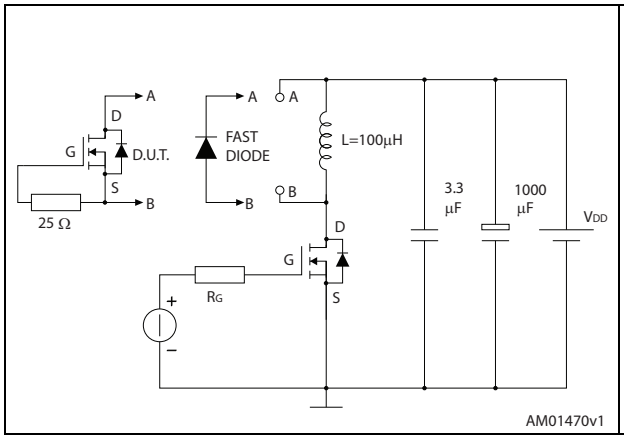


Figure 16. Unclamped inductive load test circuit

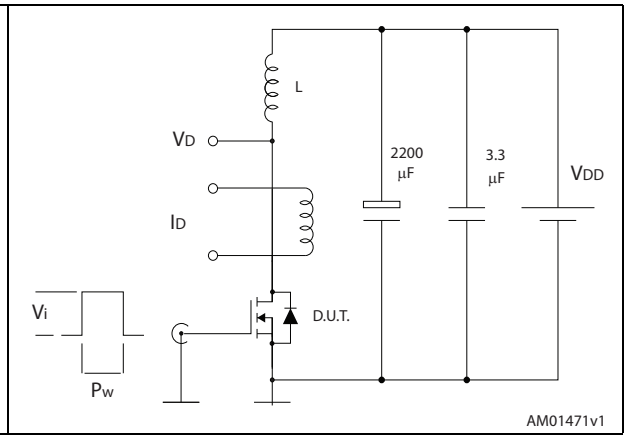


Figure 17. Unclamped inductive waveform

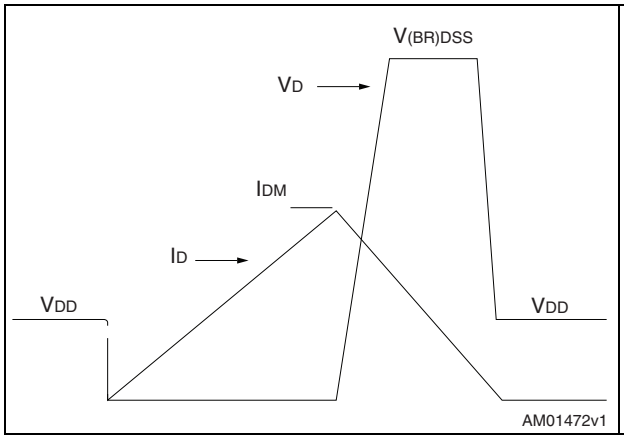
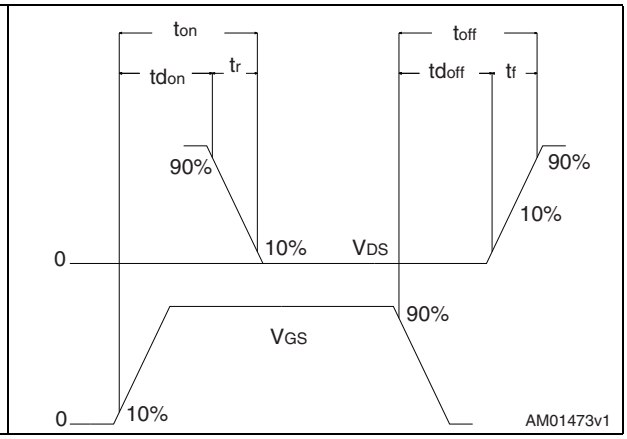


Figure 18. Switching time waveform



4 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 8. PowerFLAT 5x6 type S-R mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
D	5.00	5.20	5.40
E	5.95	6.15	6.35
D2	4.11		4.31
E2	3.50		3.70
e		1.27	
L	0.60		0.80
K	1.275		1.575

Figure 19. PowerFLAT™ 5x6 type S-R drawing

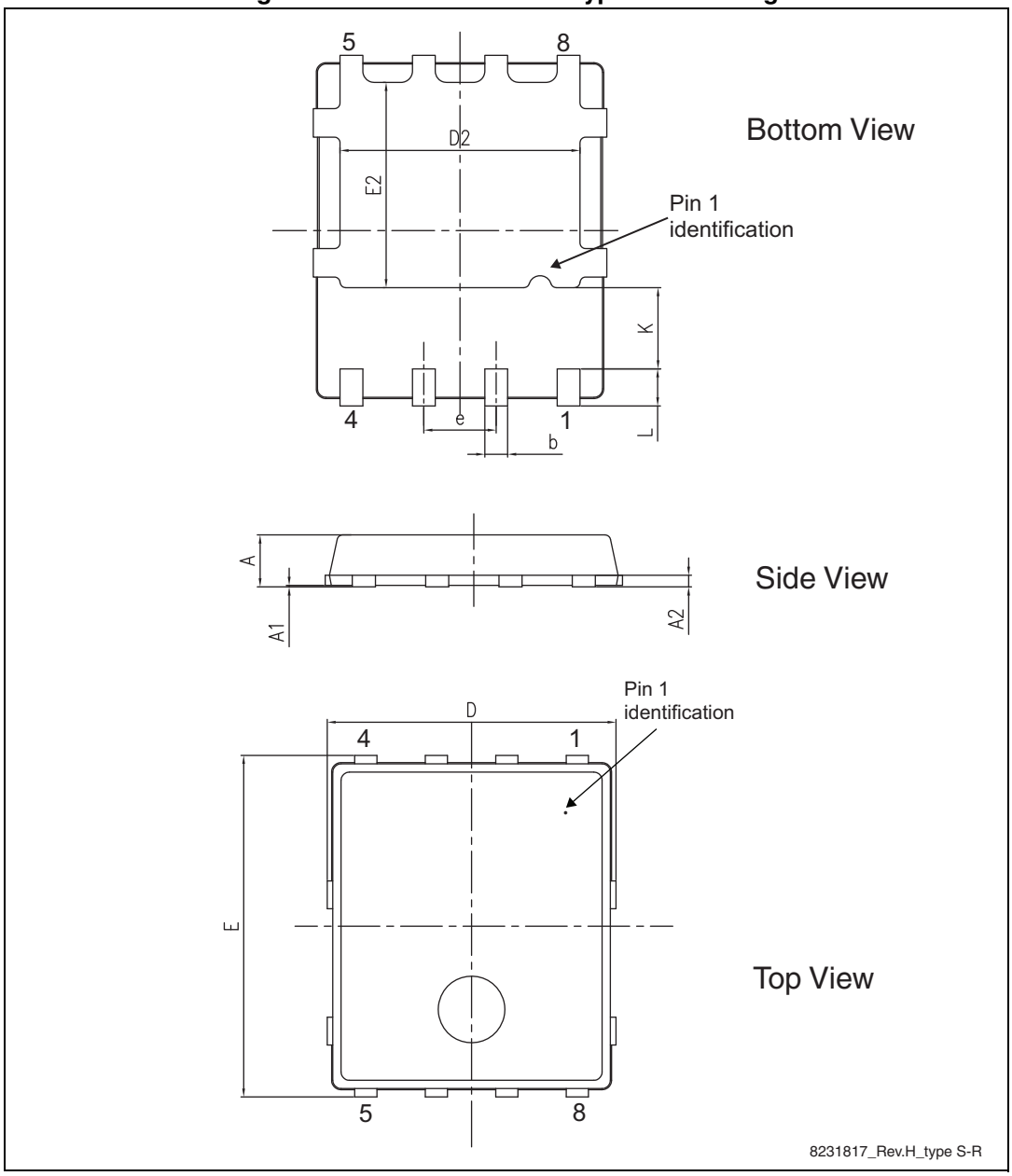
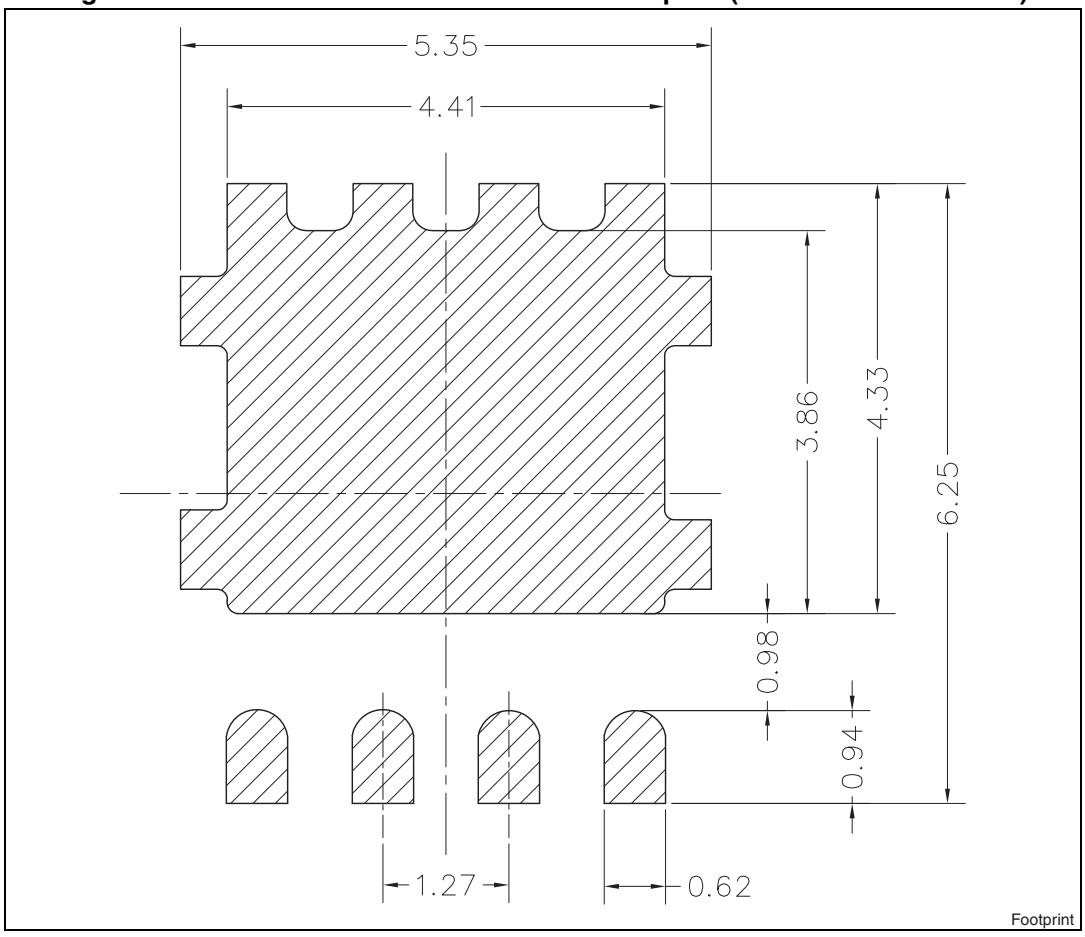


Figure 20. PowerFLAT™ 5x6 recommended footprint (dimensions are in mm)



5 Packaging mechanical data

Figure 21. PowerFLAT™ 5x6 tape[(a)]

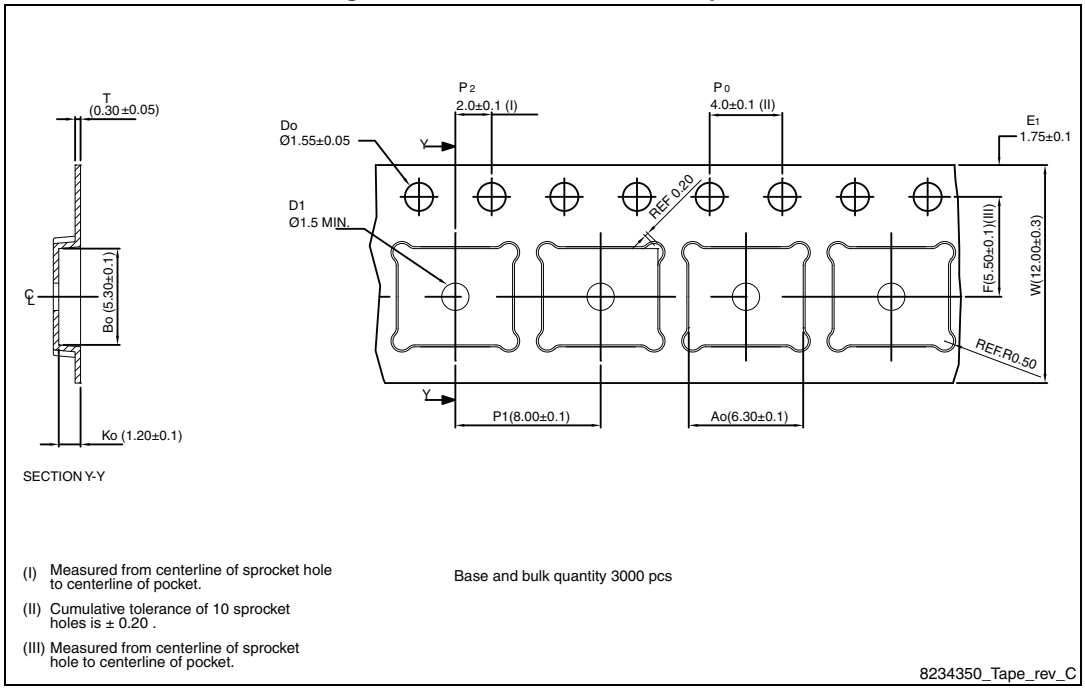
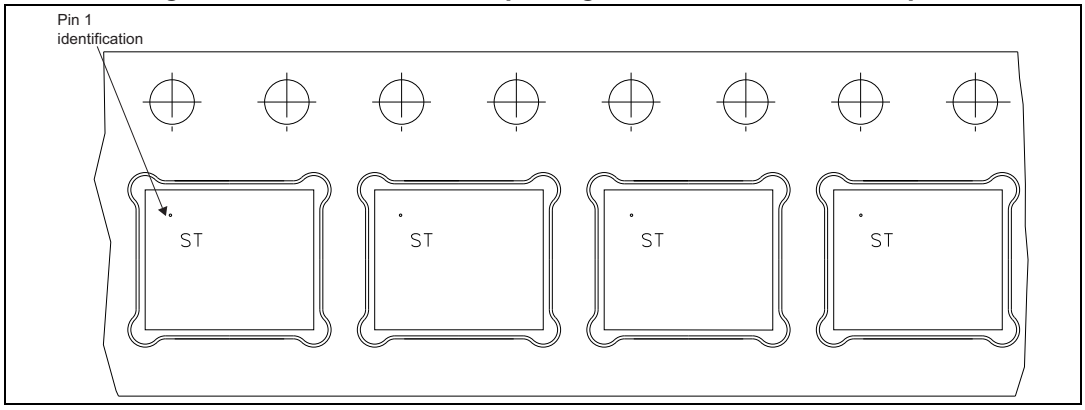
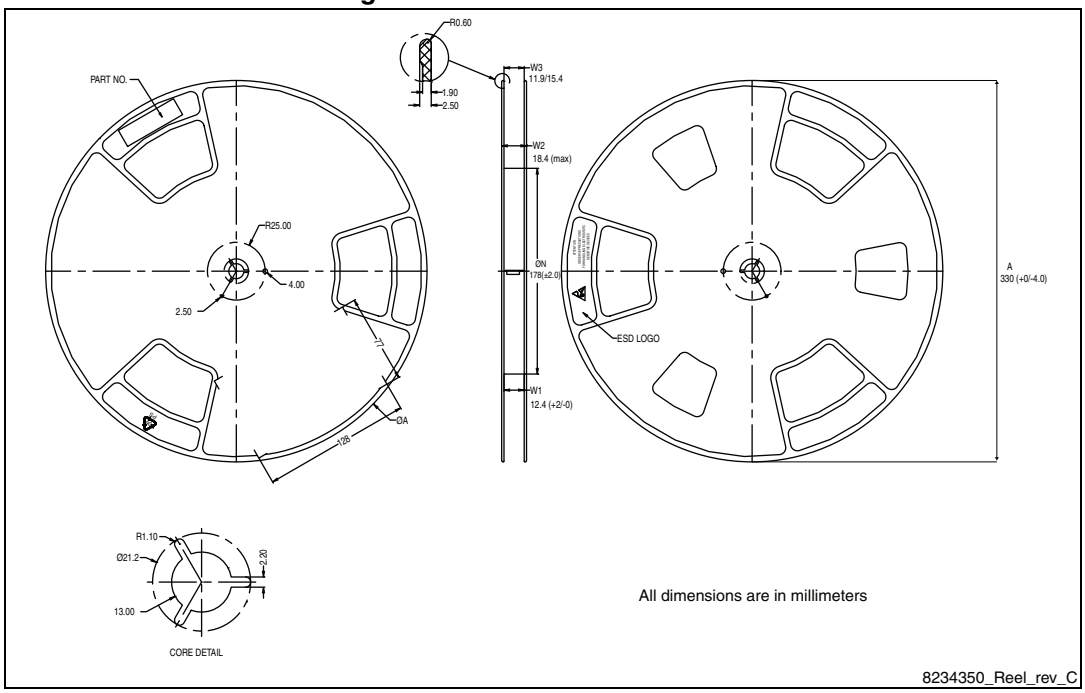


Figure 22. PowerFLAT™ 5x6 package orientation in carrier tape.



a. All dimensions are in millimeters.

Figure 23. PowerFLAT™ 5x6 reel



6 Revision history

Table 9. Document revision history

Date	Revision	Changes
29-Mar-2013	1	First release.
23-May-2013	2	– Document status promoted from target data to production data – Modified: $V_{GS(th)}$ values in *Table 4*
28-Oct-2013	3	– Modified: title, $R_{DS(on)}$ in cover page – Modified: $R_{DS(on)}$ typical and max values in *Table 4*, C_{iss} typical value in table 5 – Added: Q_{SS} in *Table 5* – Modified: $t_{d(on)}$ and T_r typical values – Modified: T_{rr}, Q_{rr} and I_{RRM} typical values in *Table 7* – Added: *Section 2.1: Electrical characteristics (curves)* – Updated: *Section 4: Package mechanical data* – Minor text changes

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