

Automotive-grade dual N-channel 60 V, 35 mΩ typ., 6.5 A STripFET™ F3 Power MOSFET in PowerFLAT™ 5x6 double island

Datasheet - production data

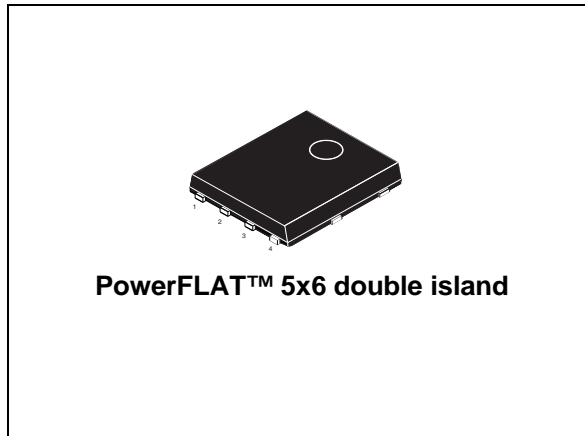
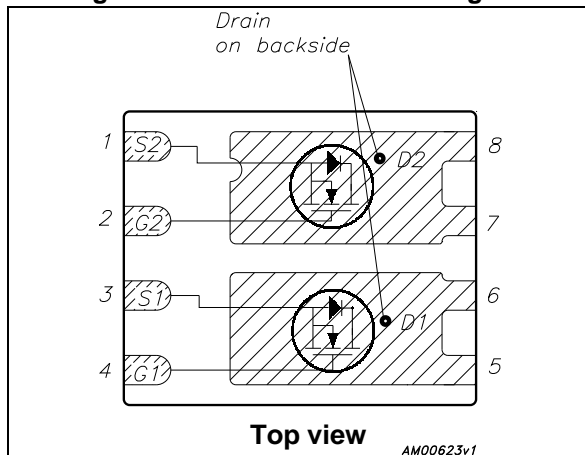


Figure 1. Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max	I _D
STL7DN6LF3	60 V	43 mΩ	6.5 A

- Designed for automotive application and AEC-Q101 qualified
- Logic level V_{GS(th)}
- 175 °C junction temperature
- 100% avalanche rated
- Wettable flank package

Applications

- Switching applications

Description

This device is a dual N-channel Power MOSFET developed using STripFET™ F3 technology. It is designed to minimize on-resistance and gate charge to provide superior switching performance.

Table 1. Device summary

Order code	Marking	Package	Packaging
STL7DN6LF3	7DN6LF3	PowerFLAT™ 5x6 double island ⁽¹⁾	Tape and reel

1. For wettable flank option, please contact ST sale offices.

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	60	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1),(2)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	20	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	16	A
$I_D^{(4)}$	Drain current (continuous) at $T_{pcb} = 25^\circ\text{C}$	6.5	A
$I_D^{(4)}$	Drain current (continuous) at $T_{pcb} = 100^\circ\text{C}$	4.6	A
$I_{DM}^{(3),(4)}$	Drain current (pulsed)	26	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	52	W
$P_{TOT}^{(4)}$	Total dissipation at $T_{pcb} = 25^\circ\text{C}$	4.3	W
I_{AV}	Not-repetitive avalanche current	6.5	A
$E_{AS}^{(5)}$	Single pulse avalanche energy	190	mJ
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 175	$^\circ\text{C}$

1. Specified by design. Not subject to production test.
2. Current is limited by bonding, with an $R_{thJC} = 2.9^\circ\text{C/W}$ the chip is able to carry 22 A at 25°C .
3. Pulse width limited by safe operating area
4. When mounted on FR-4 board of 1inch^2 , 2oz Cu, $t < 10\text{ sec}$
5. Starting $T_J = 25^\circ\text{C}$, $I_D = 8\text{ A}$, $V_{DD} = 25\text{ V}$

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	2.9	$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	35	$^\circ\text{C/W}$

1. When mounted on FR-4 board of 1inch^2 , 2oz Cu, $t < 10\text{ sec}$

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ($V_{GS} = 0$)	$I_D = 250\ \mu A$	60			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 60\ V$			1	μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\ V$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\ \mu A$	1		2.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\ V$, $I_D = 3\ A$ $V_{GS} = 5\ V$, $I_D = 3\ A$		35 48	43 60	$m\Omega$ $m\Omega$

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\ V$, $f = 1\ MHz$, $V_{GS} = 0$	-	432	-	pF
C_{oss}	Output capacitance		-	93	-	pF
C_{rss}	Reverse transfer capacitance		-	10.5	-	pF
Q_g	Total gate charge	$V_{DD} = 30\ V$, $I_D = 6.5\ A$ $V_{GS} = 10\ V$, Figure 13	-	8.7	-	nC
Q_{gs}	Gate-source charge		-	1.9	-	nC
Q_{gd}	Gate-drain charge		-	1.9	-	nC
R_G	Intrinsic gate resistance	$f = 1\ MHz$ open drain	-	6.3	-	Ω

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\ V$, $I_D = 3\ A$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\ V$ Figure 12	-	6.7	-	ns
t_r	Rise time		-	10.4	-	ns
$t_{d(off)}$	Turn-off delay time		-	32.4	-	ns
t_f	Fall time		-	5.4	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current		-		6.5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		26	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 6.5 \text{ A}, V_{GS} = 0$	-		1.3	V
t_{rr}	Reverse recovery time	$I_{SD} = 6.5 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 48 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$	-	24	-	ns
Q_{rr}	Reverse recovery charge		-	23.3	-	nC
I_{RRM}	Reverse recovery current		-	1.94	-	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

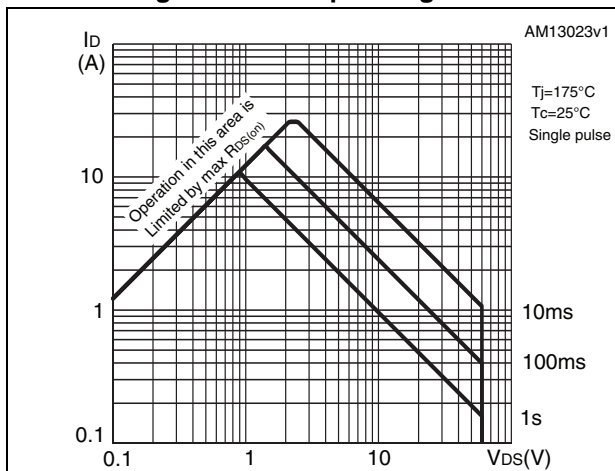


Figure 3. Thermal impedance

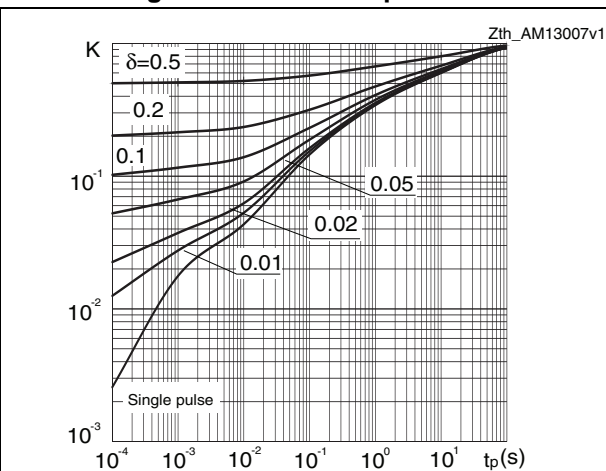


Figure 4. Output characteristics

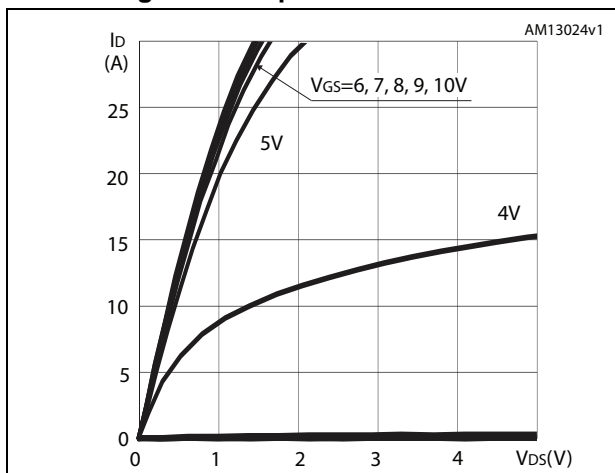


Figure 5. Transfer characteristics

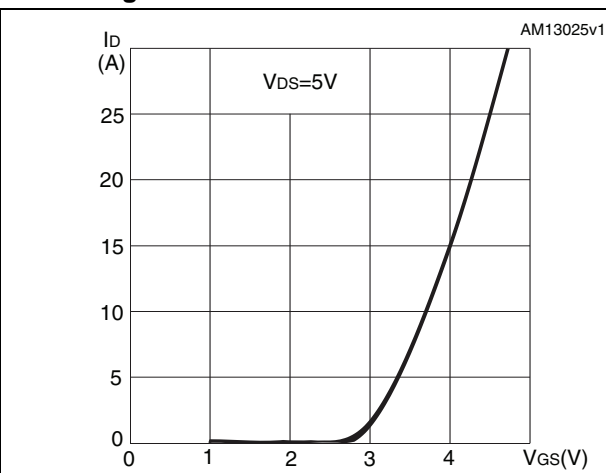


Figure 6. Normalized $V_{(BR)DSS}$ vs temperature

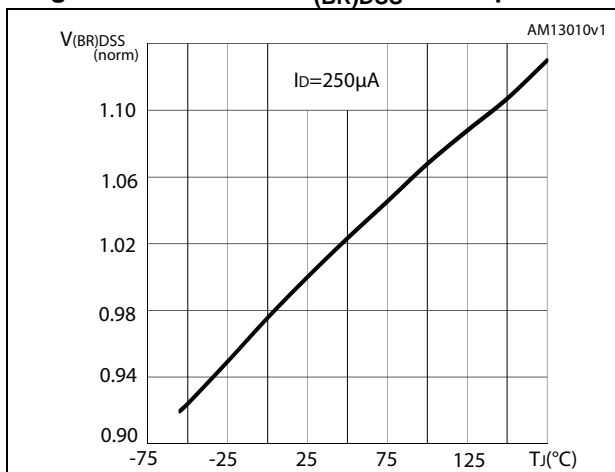


Figure 7. Static drain-source on-resistance

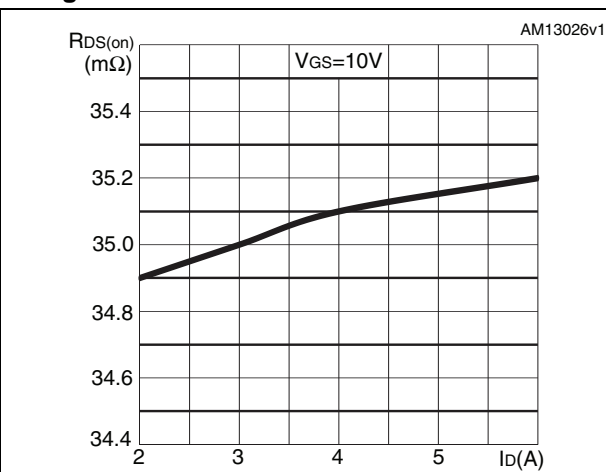


Figure 8. Gate charge vs gate-source voltage

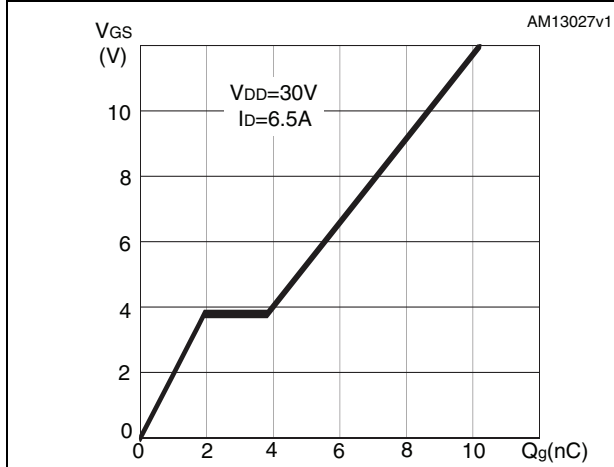


Figure 9. Capacitance variations

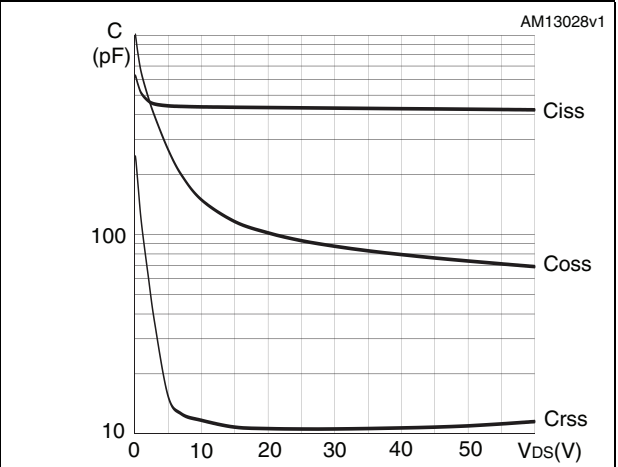


Figure 10. Normalized gate threshold voltage vs temperature

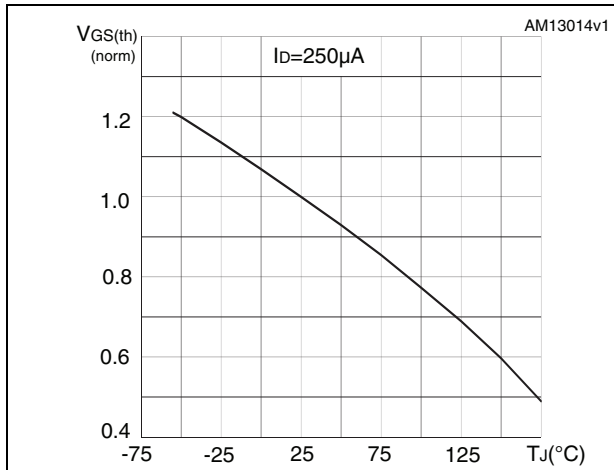
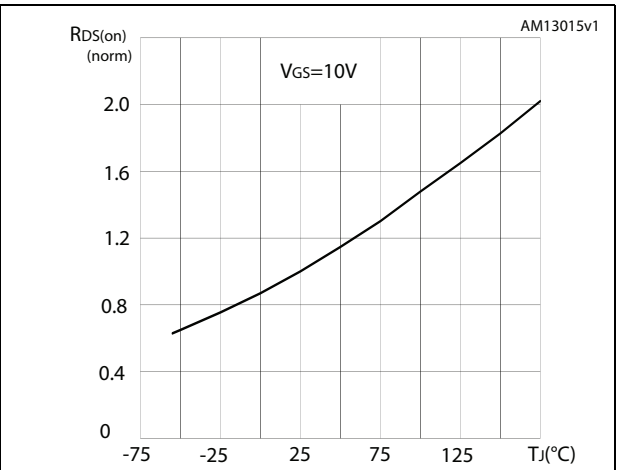


Figure 11. Normalized on-resistance vs temperature



3 Test circuits

Figure 12. Switching times test circuit for resistive load



Figure 13. Gate charge test circuit



Figure 14. Test circuit for inductive load switching and diode recovery times

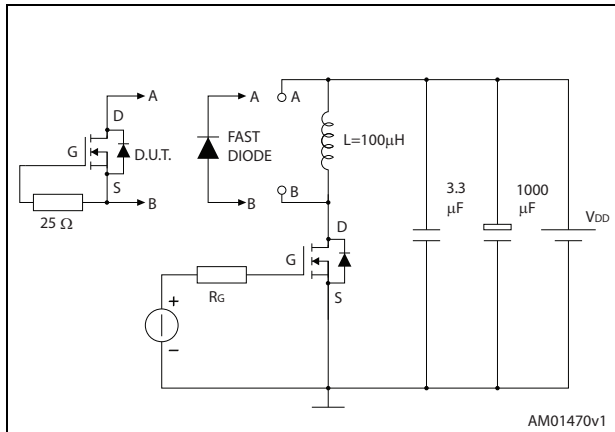


Figure 15. Unclamped inductive load test circuit



Figure 16. Unclamped inductive waveform

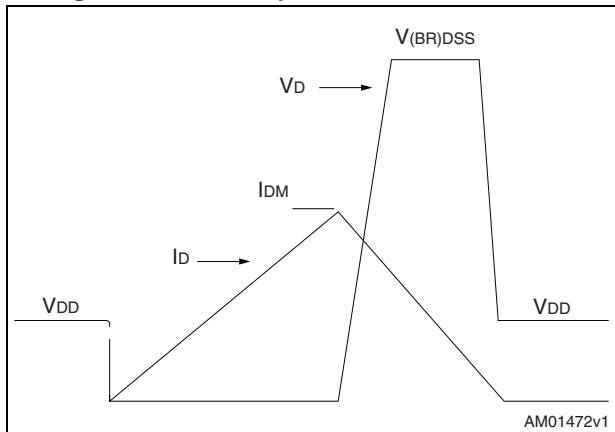


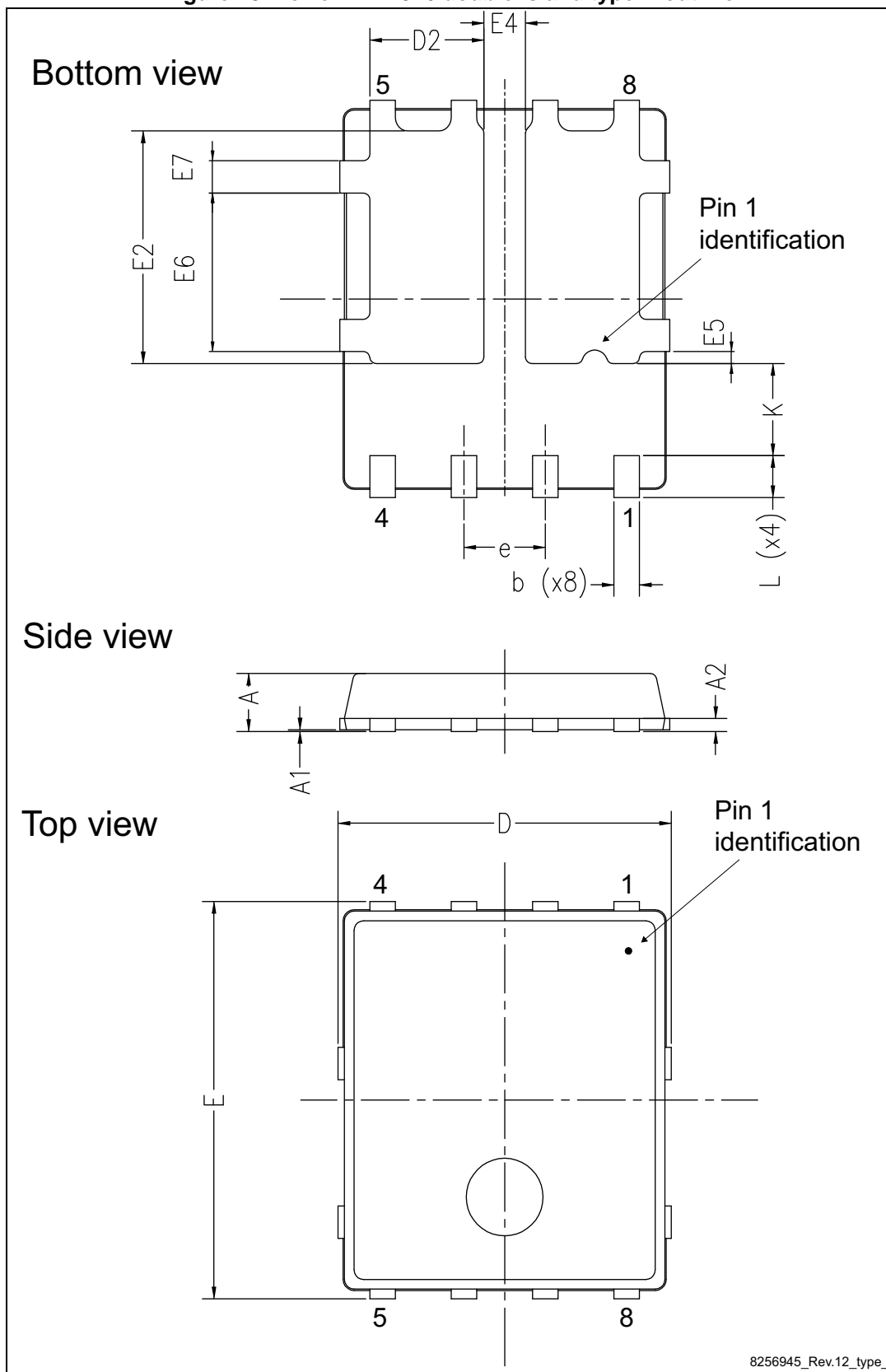
Figure 17. Switching time waveform



4 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.

Figure 18. PowerFLAT 5x6 double island type R outline



8256945_Rev.12_type_I

Table 8. PowerFLAT 5x6 double island type R mechanical data

Ref.	Dimensions (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
D2	1.68		1.88
E	5.95	6.15	6.35
E2	3.50		3.70
E4	0.55		0.75
E5	0.08		0.28
E6	2.35		2.55
E7	0.40		0.60
e		1.27	
L	0.60		0.80
K	1.275		1.575

Figure 19. PowerFLAT 5x6 double island WF type R outline

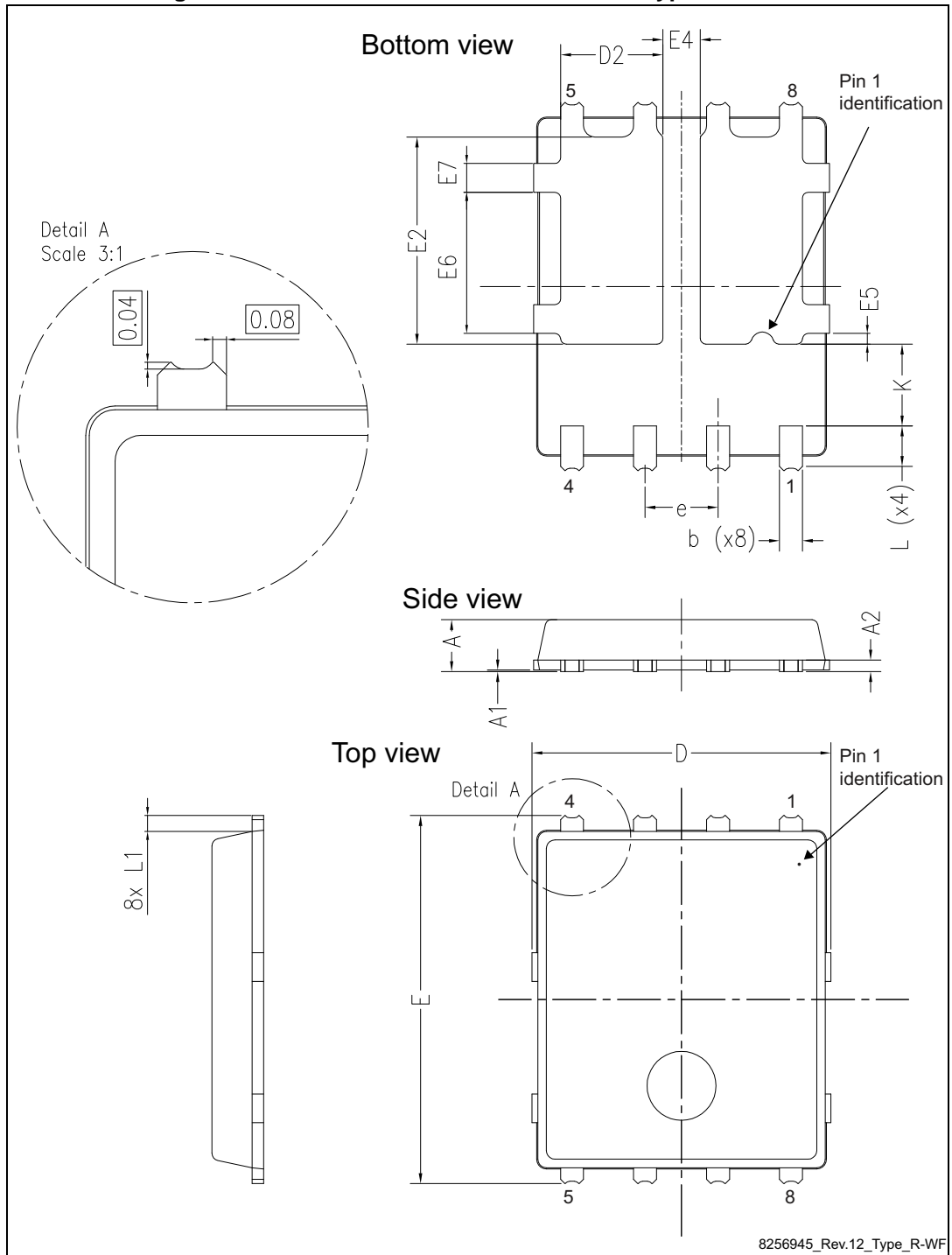
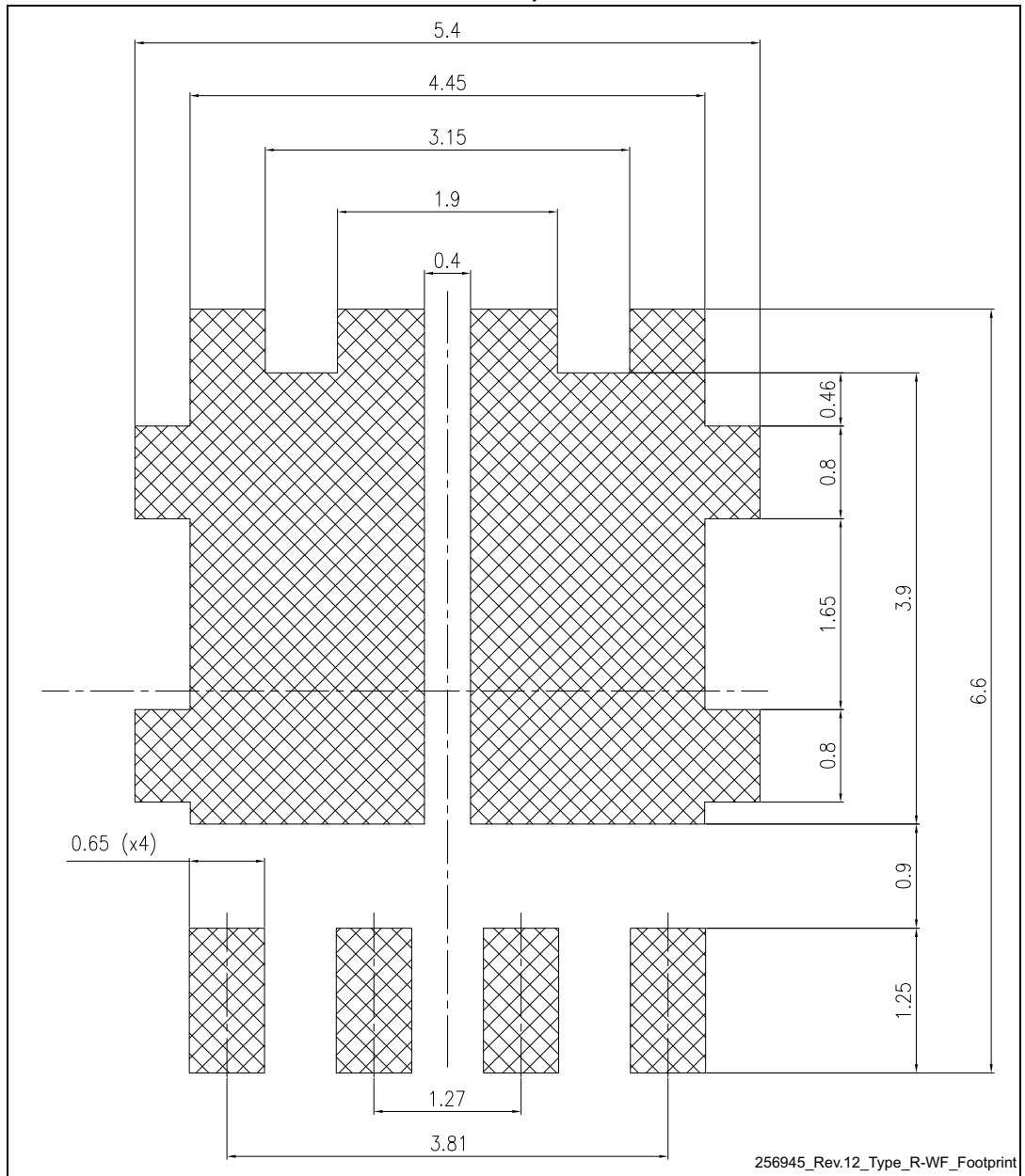


Table 9. PowerFLAT 5x6 double island WF type R mechanical data

Ref.	Dimensions (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
D2	1.68		1.88
E	6.20	6.40	6.60
E2	3.50		3.70
E4	0.55		0.75
E5	0.08		0.28
E6	2.35		2.55
E7	0.40		0.60
e		1.27	
L	0.70		0.90
L1		0.275	
K	1.275		1.575

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



5 Packaging information

Figure 21. PowerFLAT™ 5x6 tape^(a)

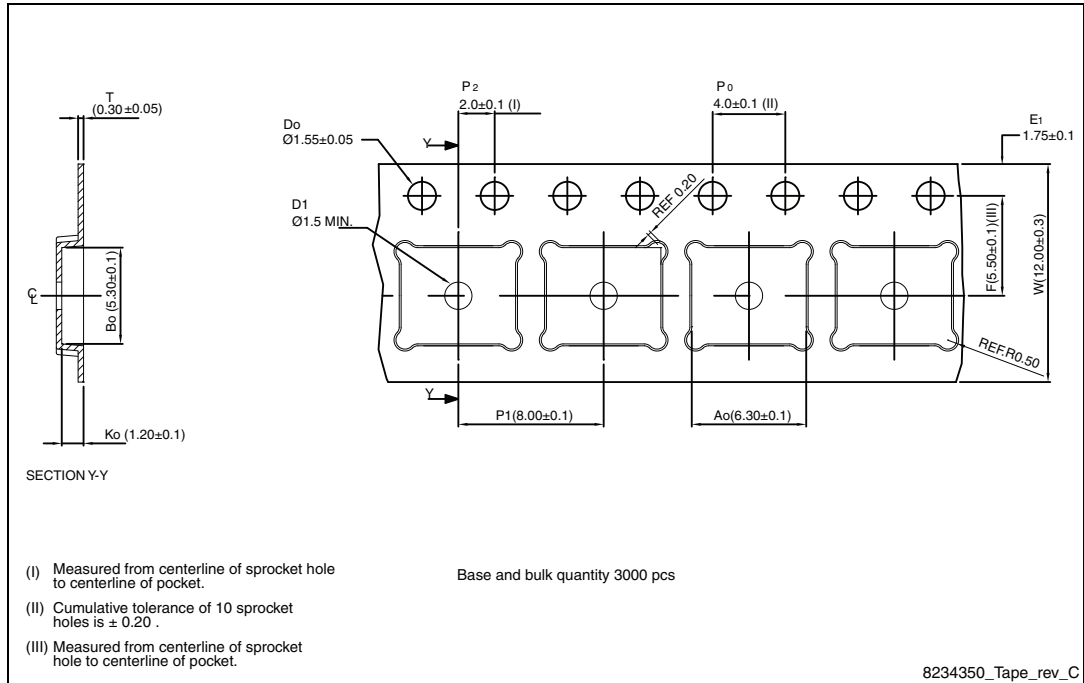
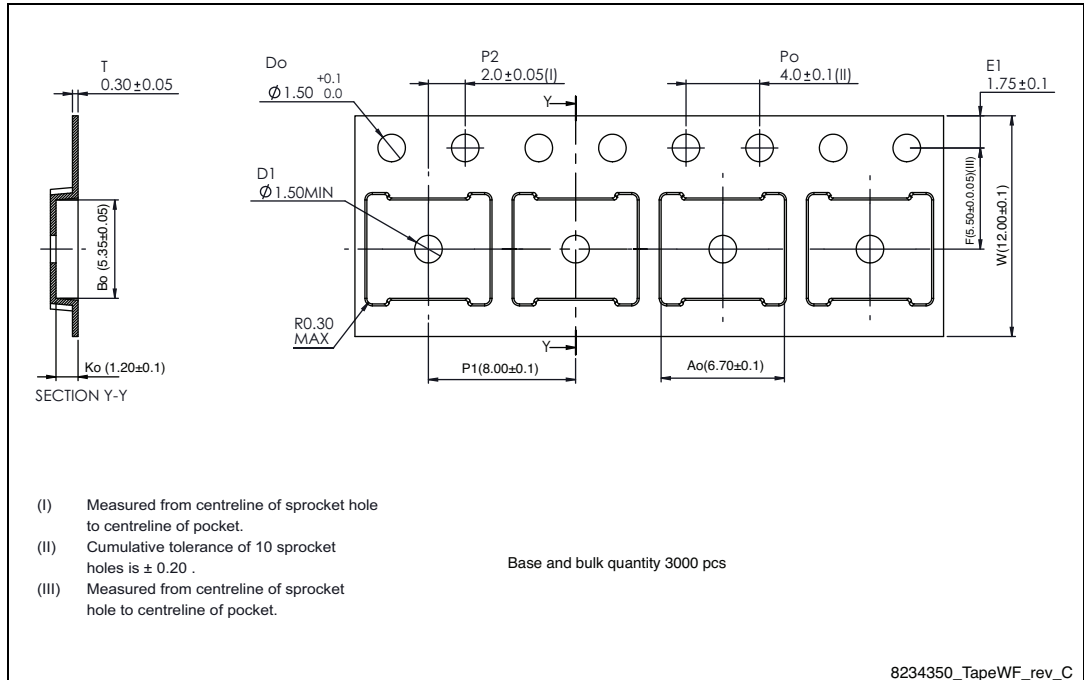


Figure 22. PowerFLAT 5x6 WF tape^(a)



a. All dimensions are in millimeters.

Figure 23. PowerFLAT™ 5x6 package orientation in carrier tape

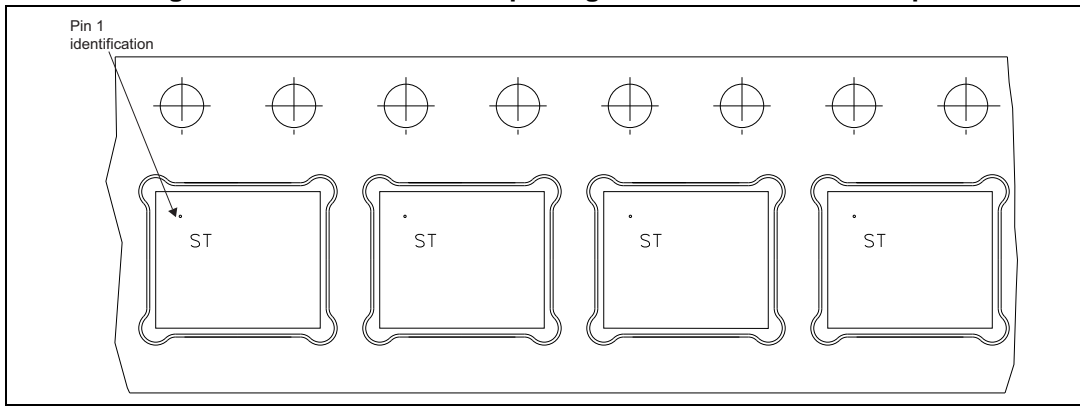
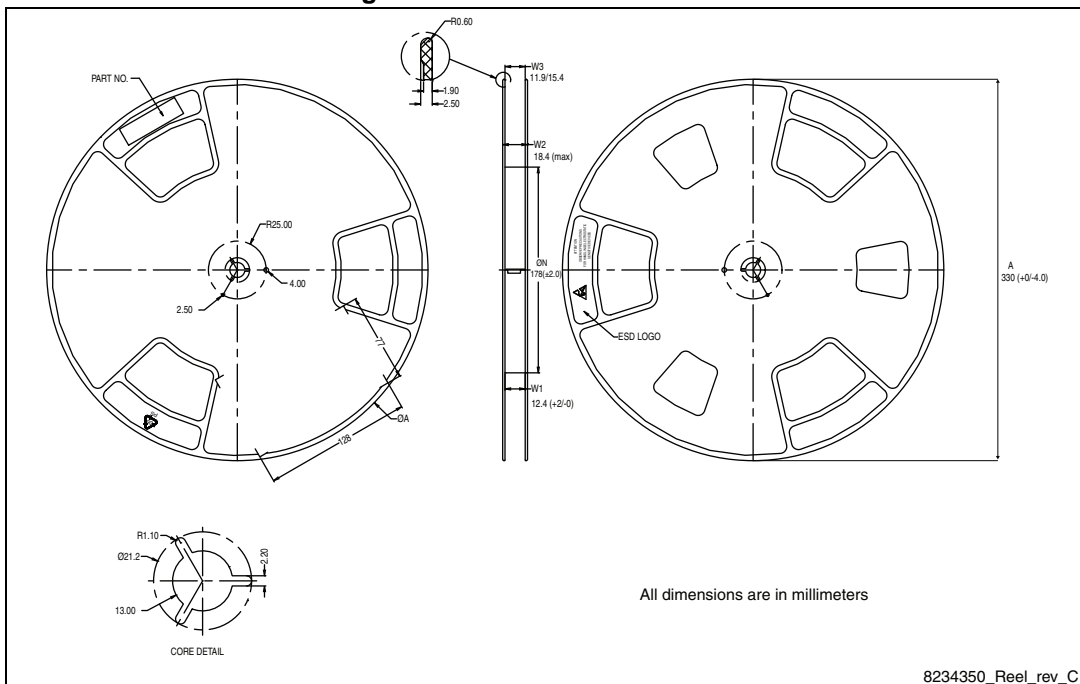


Figure 24. PowerFLAT™ 5x6 reel



6 Revision history

Table 10. Document revision history

Date	Revision	Changes
28-Mar-2012	1	First release.
19-Jun-2012	2	Section 2.1: Electrical characteristics (curves) has been added. Updated Section 4: Package information and tile on the coverpage.
26-Jun-2012	3	Document status promoted from preliminary to production data.
23-Feb-2015	4	Updated title, features and description in cover page. Updated Table 5: Dynamic , Table 6: Switching times and Section 2.1: Electrical characteristics (curves) . Updated Section 4: Package information . Added Section 5: Packaging information . Minor text changes.

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