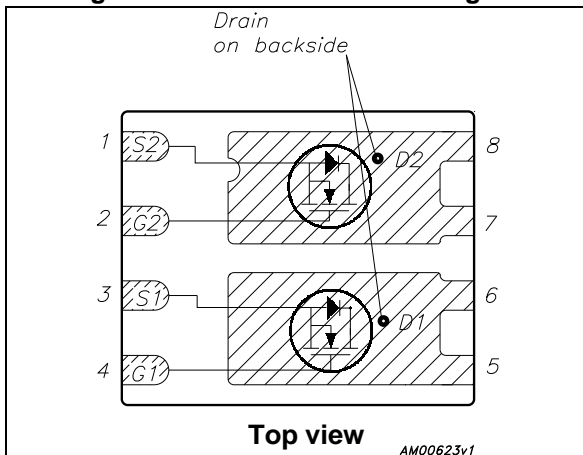


## Automotive-grade dual N-channel 60 V, 35 mΩ typ., 6.5 A STripFET™ F3 Power MOSFET in PowerFLAT™ 5x6 double island

Datasheet - production data



Figure 1. Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STL7DN6LF3	60 V	43 mΩ	6.5 A

- Designed for automotive application and AEC-Q101 qualified
- Logic level V<sub>GS(th)</sub>
- 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 <sup>(1)</sup>	Tape and reel

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

# Contents

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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	$\pm 20$	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  $25^\circ\text{C}$ .
3. Pulse width limited by safe operating area
4. When mounted on FR-4 board of  $1\text{inch}^2$ , 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  $1\text{inch}^2$ , 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	$\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\ V$			$\pm 100$	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	$V_{DD} = 30\ V$ , $I_D = 6.5\ A$ $V_{GS} = 10\ V$ , <a href="#">Figure 13</a>	-	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	-	$\Omega$

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\ V$ , $I_D = 3\ A$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\ V$ <a href="#">Figure 12</a>	-	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  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

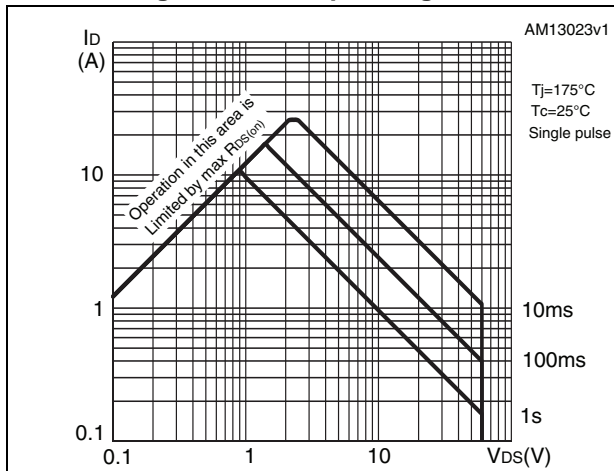


Figure 3. Thermal impedance

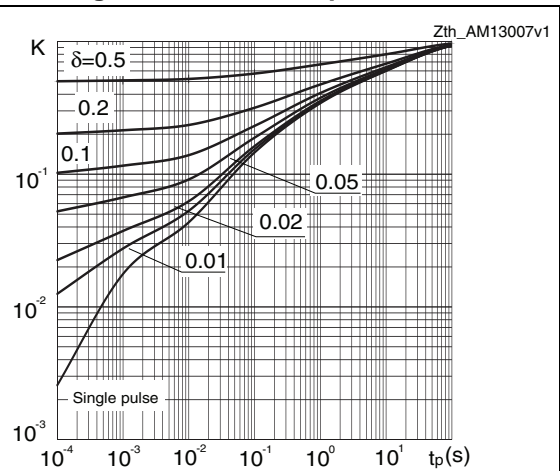


Figure 4. Output characteristics

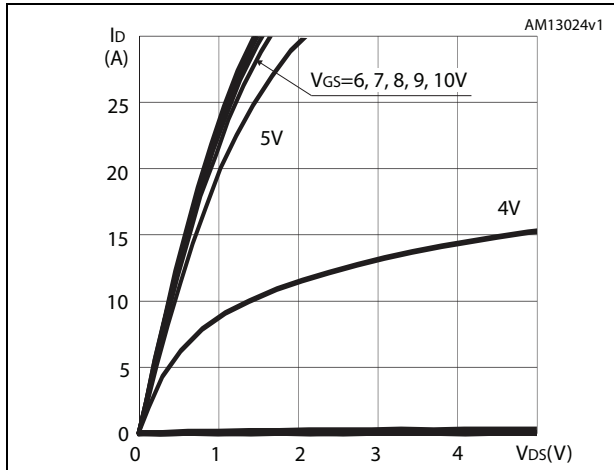


Figure 5. Transfer characteristics

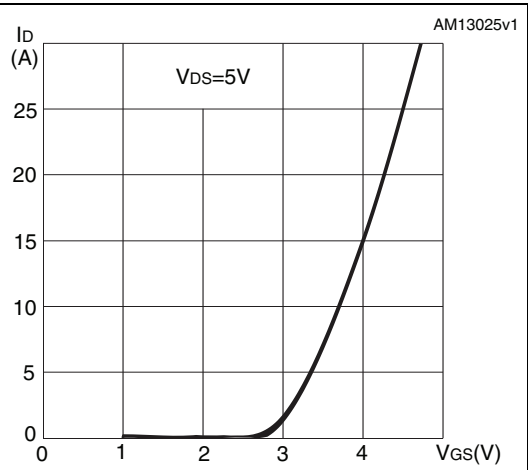


Figure 6. Normalized  $V_{(BR)DSS}$  vs temperature

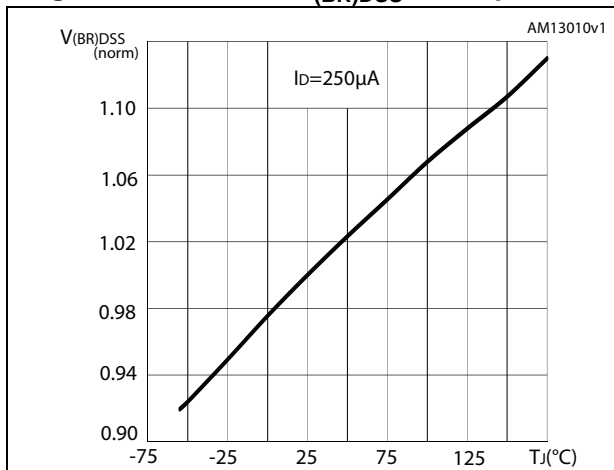


Figure 7. Static drain-source on-resistance

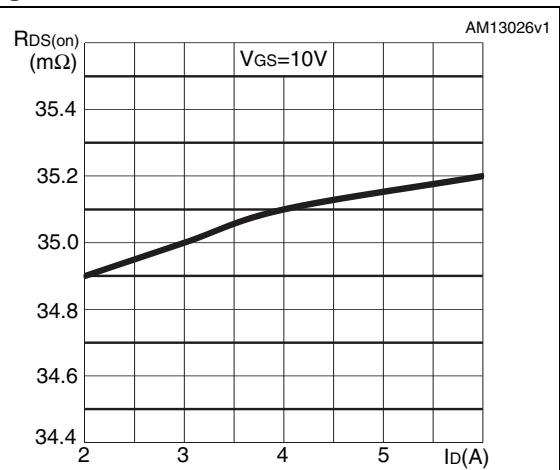


Figure 8. Gate charge vs gate-source voltage

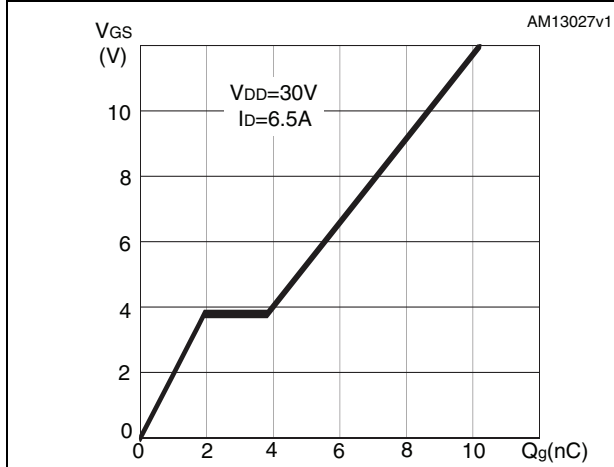


Figure 9. Capacitance variations

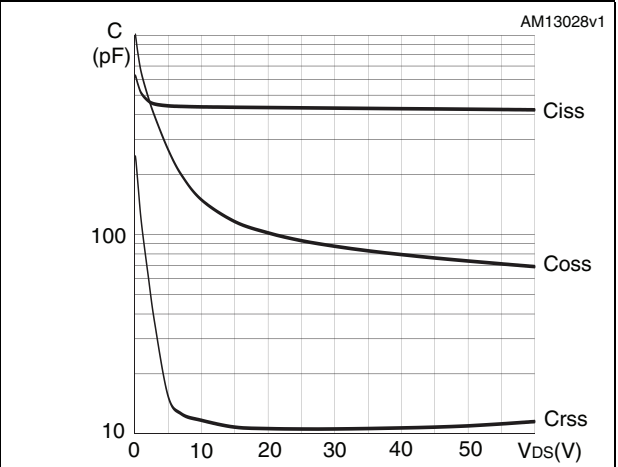


Figure 10. Normalized gate threshold voltage vs temperature

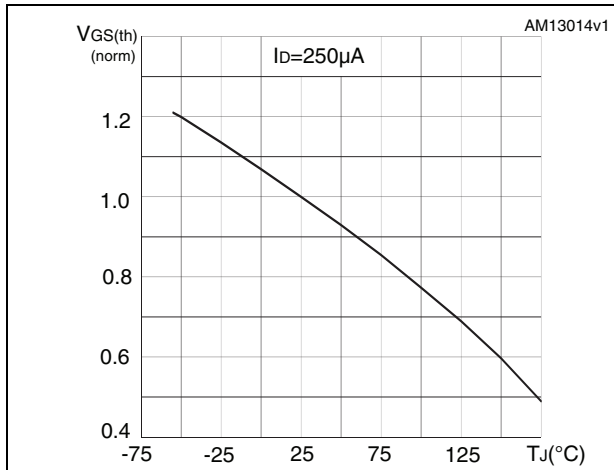
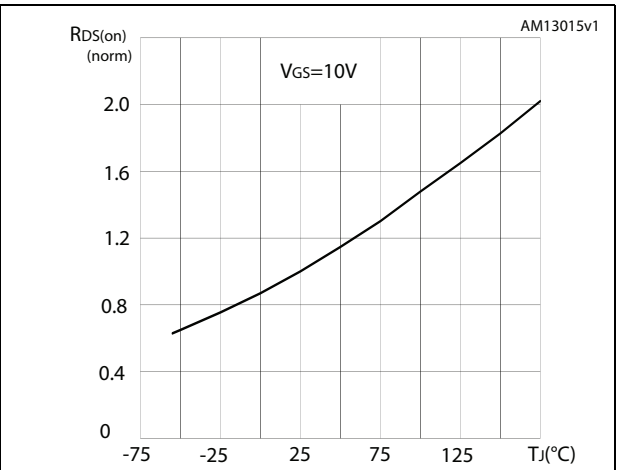


Figure 11. Normalized on-resistance vs temperature



### 3 Test circuits

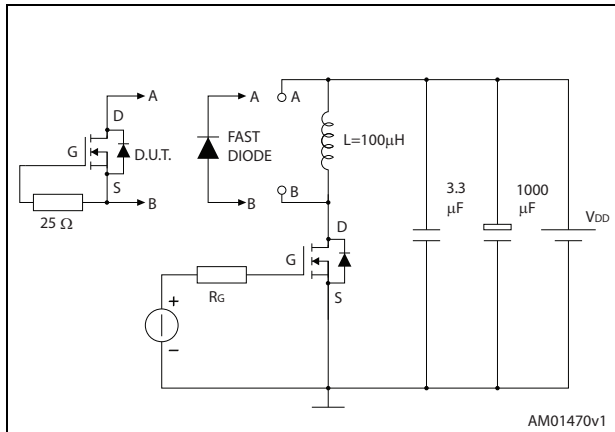
**Figure 12. Switching times test circuit for resistive load**



**Figure 13. Gate charge test circuit**



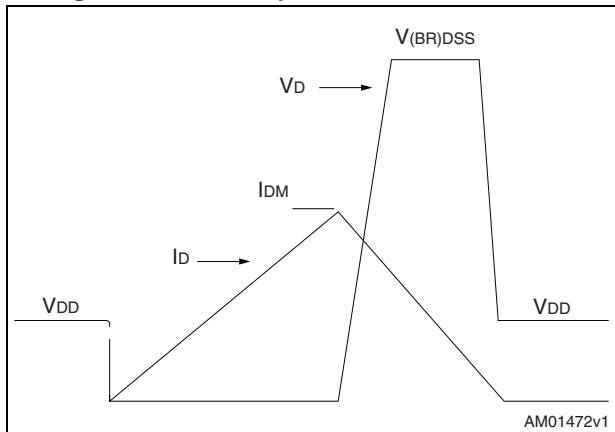
**Figure 14. Test circuit for inductive load switching and diode recovery times**



**Figure 15. Unclamped inductive load test circuit**



**Figure 16. Unclamped inductive waveform**



**Figure 17. Switching time waveform**

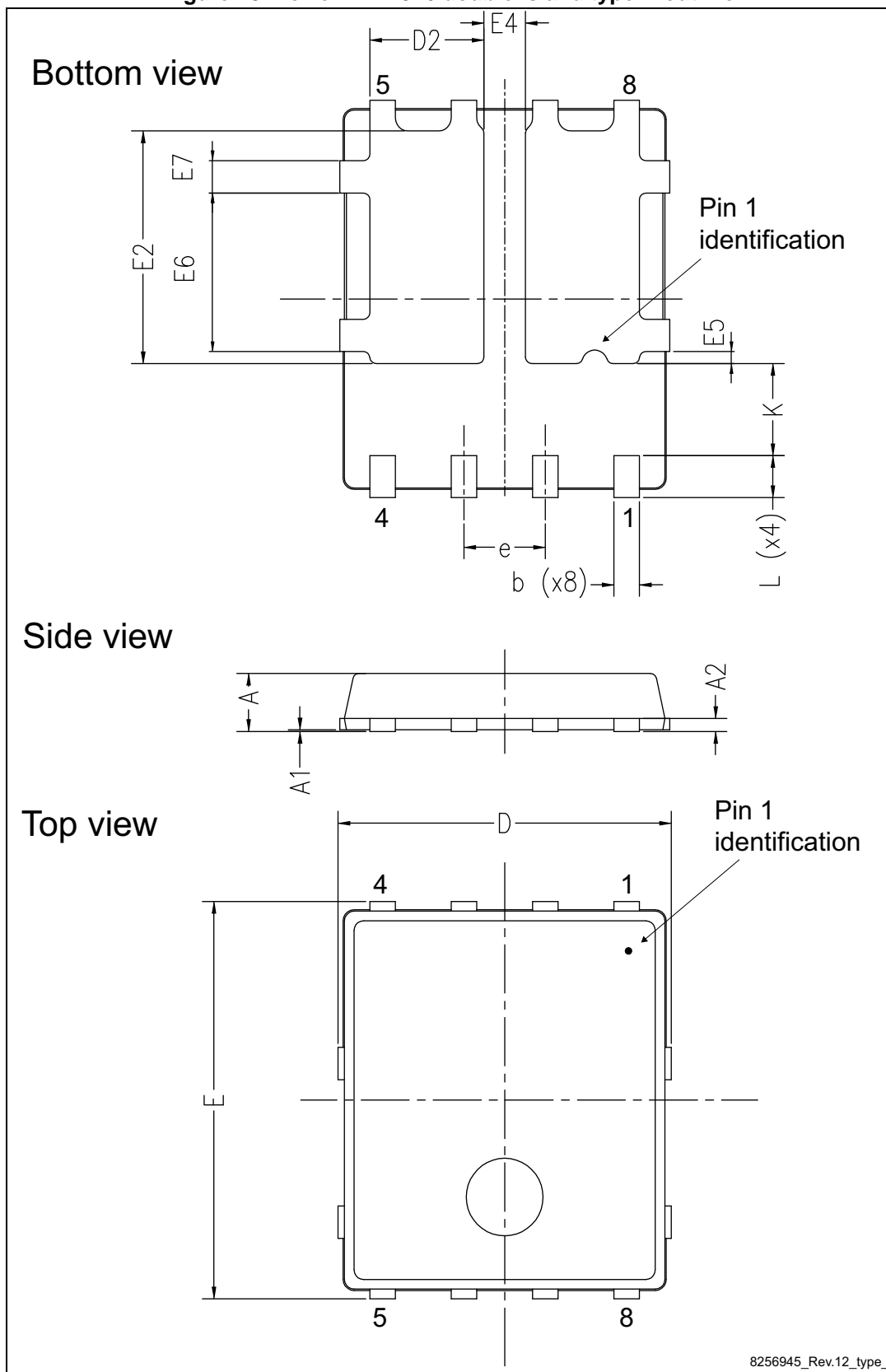




## 4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://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

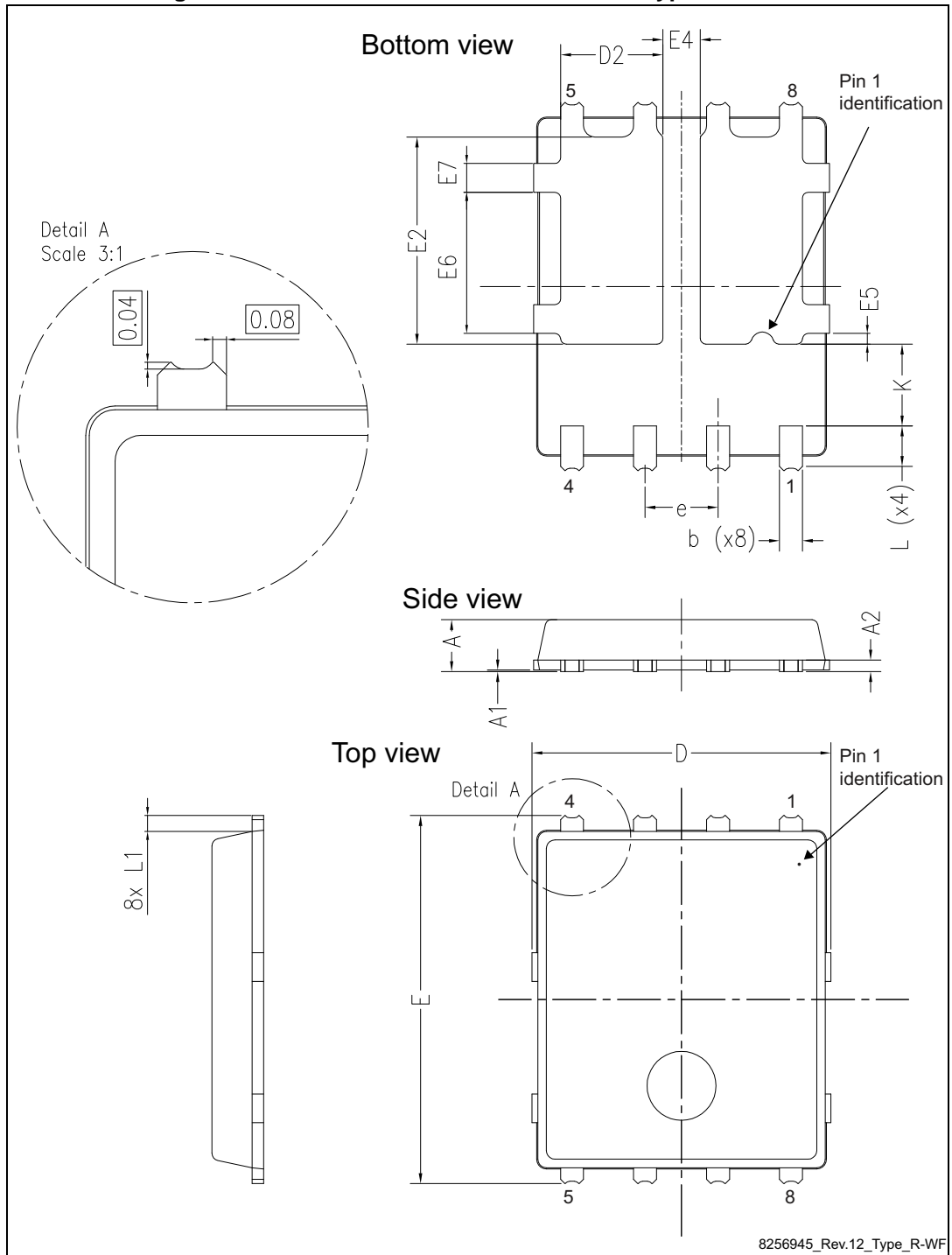
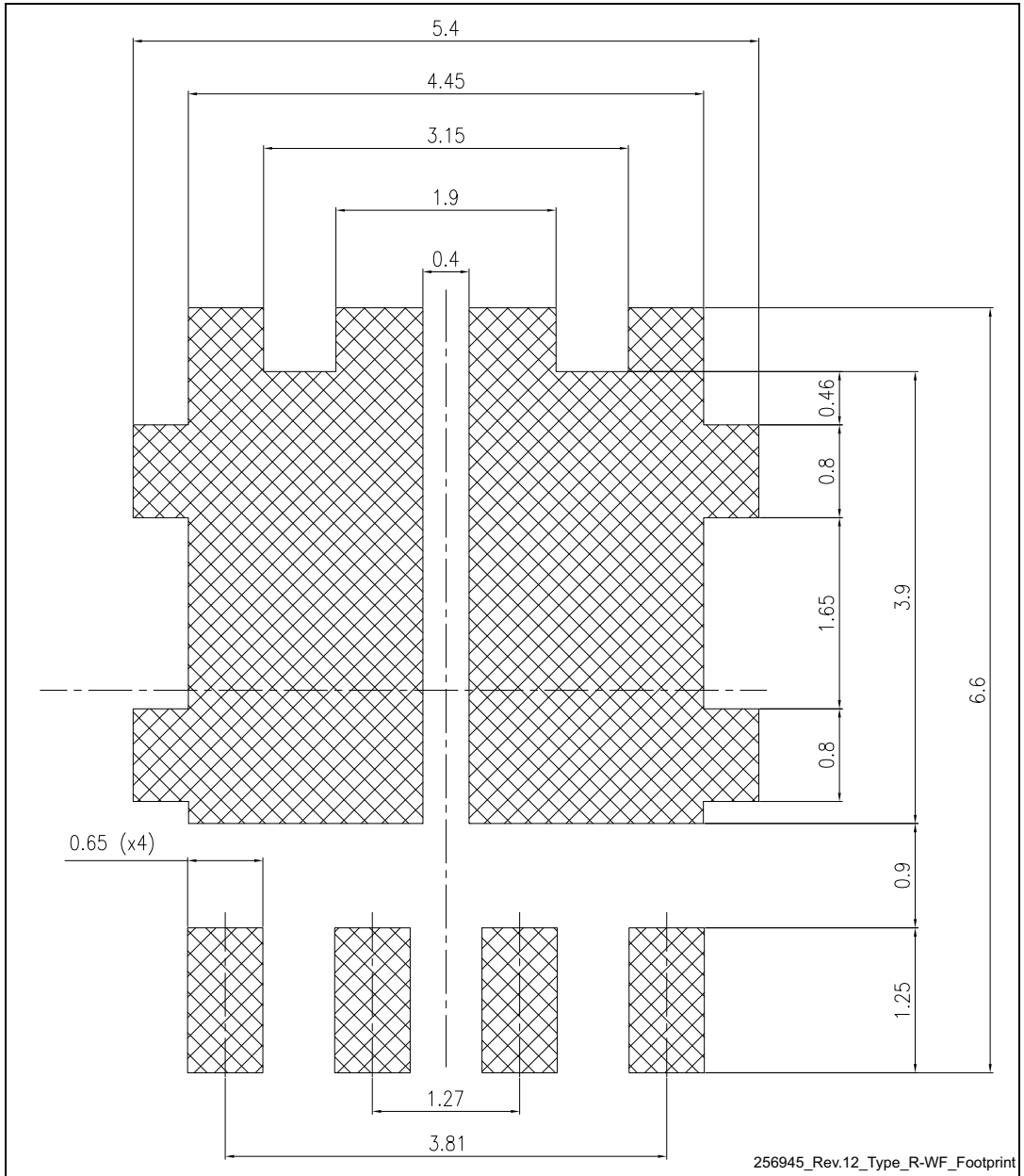


Table 9. PowerFLAT 5x6 double island WF type R mechanical data

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<sup>(a)</sup>

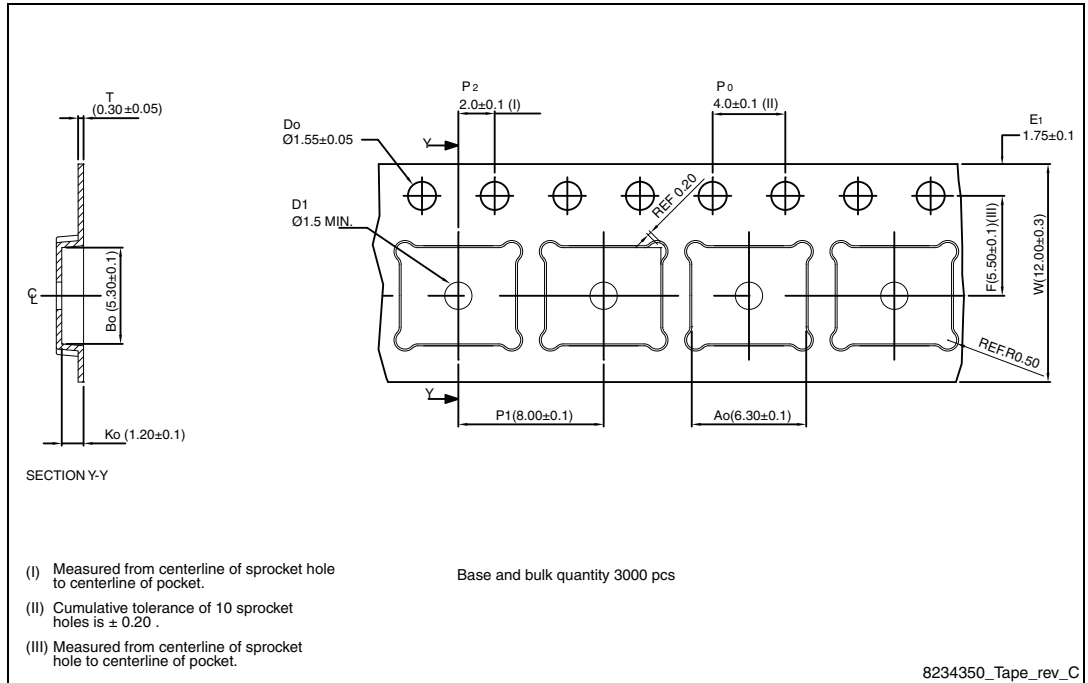
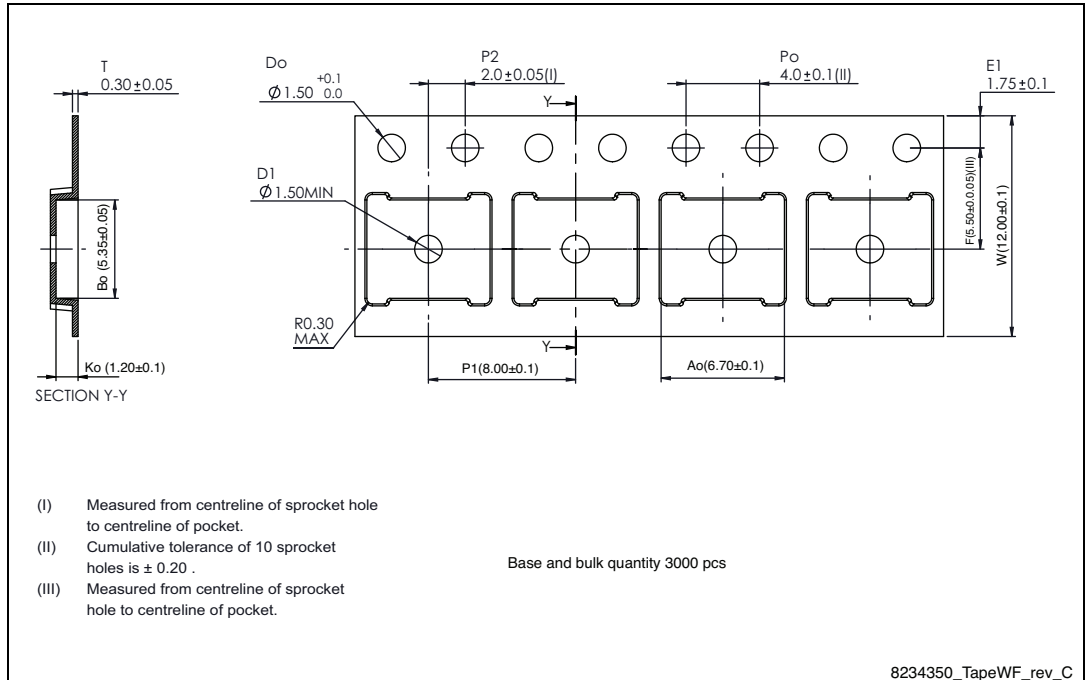


Figure 22. PowerFLAT 5x6 WF tape<sup>(a)</sup>



a. All dimensions are in millimeters.

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

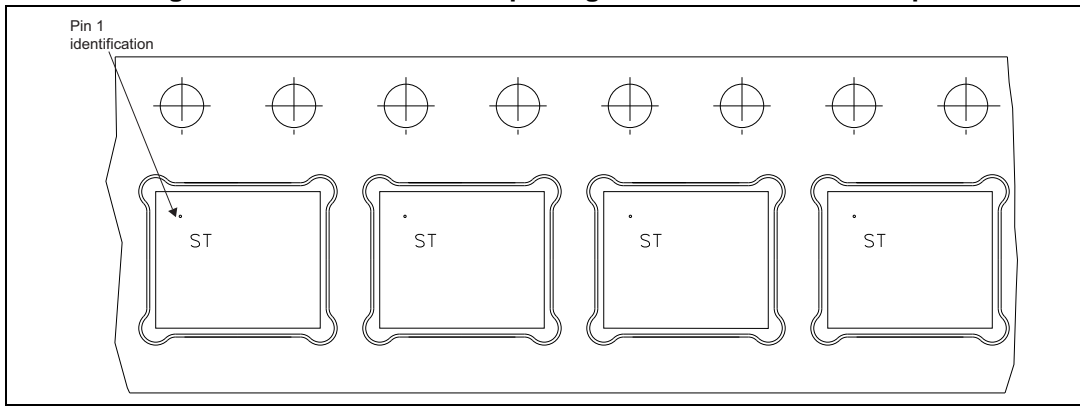
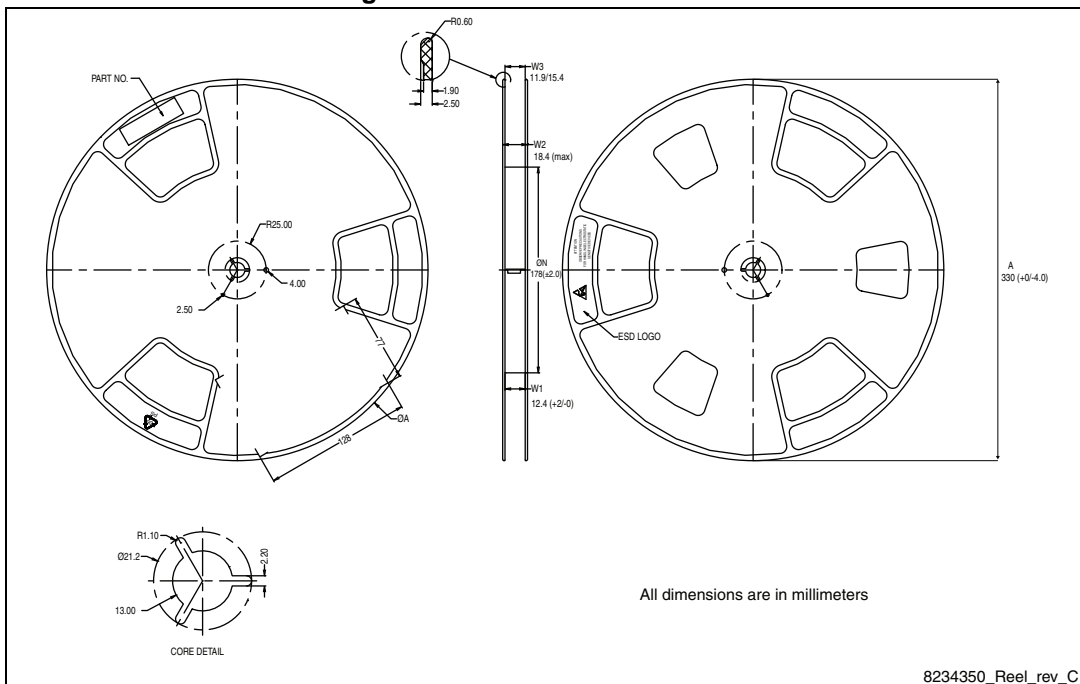


Figure 24. PowerFLAT™ 5x6 reel





## 6 Revision history

Table 10. Document revision history

Date	Revision	Changes
28-Mar-2012	1	First release.
19-Jun-2012	2	<a href="#">Section 2.1: Electrical characteristics (curves)</a> has been added. Updated <a href="#">Section 4: Package information</a> 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 <a href="#">Table 5: Dynamic</a> , <a href="#">Table 6: Switching times</a> and <a href="#">Section 2.1: Electrical characteristics (curves)</a> . Updated <a href="#">Section 4: Package information</a> . Added <a href="#">Section 5: Packaging information</a> . Minor text changes.

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