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## Automotive-grade dual N-channel 40 V, 8 mΩ typ., 15 A STripFET™ F5 Power MOSFET in a PowerFLAT™ 5x6 DI

Datasheet - production data

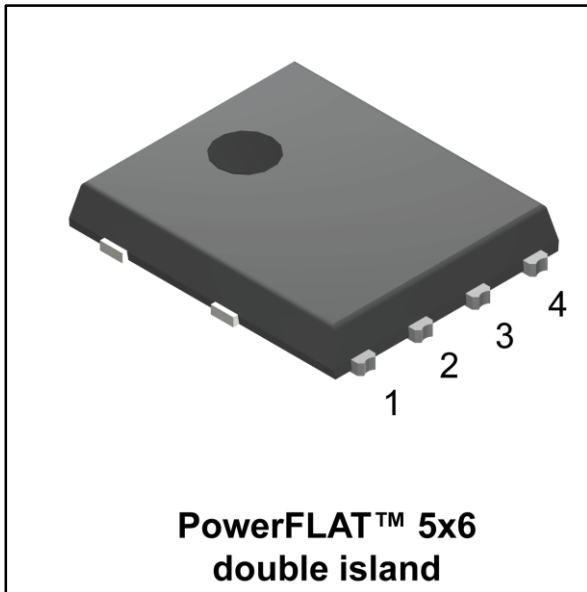


Figure 1: Internal schematic diagram

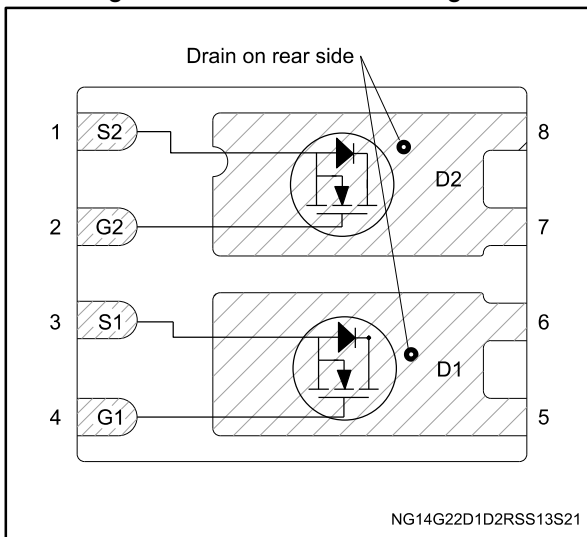


Table 1: Device summary

Order code	Marking	Package	Packing
STL15DN4F5	15DN4F5	PowerFLAT™ 5x6 double island	Tape and reel

### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STL15DN4F5	40 V	9 mΩ	15 A

- Designed for automotive applications and AEC-Q101 qualified
- Extremely low R<sub>DS(on)</sub>
- Very low gate charge
- Low gate drive power loss
- Wettable flank package

### Applications

- Switching applications

### Description

This device is a dual N-channel Power MOSFET developed using STMicroelectronics' STripFET™ F5 technology. The device has been optimized to achieve very low on-state resistance, contributing to a FoM that is among the best in its class.

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## Contents

<b>1</b>	<b>Electrical ratings .....</b>	<b>3</b>
<b>2</b>	<b>Electrical characteristics .....</b>	<b>4</b>
	2.1 Electrical characteristics (curves) .....	6
<b>3</b>	<b>Test circuits .....</b>	<b>8</b>
<b>4</b>	<b>Package information .....</b>	<b>9</b>
	4.1 PowerFLAT 5x6 double island WF type C package information .....	10
	4.2 Packing information.....	13
<b>5</b>	<b>Revision history .....</b>	<b>15</b>

# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	40	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	60	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	15	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	10	A
$I_{DM}^{(2)(3)}$	Drain current (pulsed)	60	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	60	W
$P_{TOT}^{(2)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	4.3	W
$T_j$	Operating junction temperature range	-55 to 175	$^\circ\text{C}$
$T_{stg}$	Storage temperature range		

**Notes:**

(1)The value is rated according  $R_{thj-c}$ .

(2)The value is rated according  $R_{thj-pcb}$ .

(3)Pulse width limited by safe operating area.

**Table 3: Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	2.5	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	35	$^\circ\text{C}/\text{W}$

**Notes:**

(1)When mounted on FR-4 board of 1 inch<sup>2</sup>, 2oz Cu,  $t < 10\text{ }s$ .

**Table 4: Avalanche data**

Symbol	Parameter	Value	Unit
$I_{AV}$	Not-repetitive avalanche current, (pulse width limited by $T_j$ max.)	7.5	A
$E_{AS}^{(1)}$	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$ , $I_D = I_{AV}$ , $V_{DD} = 24\text{ V}$ )	150	mJ

**Notes:**

(1)Tested at wafer level only.

## 2 Electrical characteristics

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

**Table 5: On/Off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	40			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$ , $V_{DS} = 40\text{ V}$			1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$ , $V_{DS} = 40\text{ V}$ , $T_C = 125\text{ °C}$ <sup>(1)</sup>			10	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current	$V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$ , $I_D = 7.5\text{ A}$		8	9	m $\Omega$

**Notes:**

<sup>(1)</sup>Defined by design, not subject to production test

**Table 6: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	1550	-	pF
$C_{oss}$	Output capacitance		-	230	-	
$C_{rss}$	Reverse transfer capacitance		-	25	-	
$Q_g$	Total gate charge	$V_{DD} = 20\text{ V}$ , $I_D = 15\text{ A}$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 14: "Test circuit for gate charge behavior"</a> )	-	25	-	nC
$Q_{gs}$	Gate-source charge		-	6	-	
$Q_{gd}$	Gate-drain charge		-	5.5	-	

**Table 7: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20\text{ V}$ , $I_D = 7.5\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 13: "Test circuit for resistive load switching times"</a> )	-	18	-	ns
$t_r$	Rise time		-	45	-	
$t_{d(off)}$	Turn-off delay time		-	32	-	
$t_f$	Fall time		-	5	-	

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Forward on voltage		-		15	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		60	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0, I_{SD} = 15 \text{ A}$	-		1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 15 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$	-	30		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 32 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$ (see <a href="#">Figure 15: "Test circuit for inductive load switching and diode recovery times"</a> )	-	35		nC
$I_{RRM}$	Reverse recovery current		-	2.2		A

**Notes:**

<sup>(1)</sup>Pulse width limited by safe operating area

<sup>(2)</sup>Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

## 2.2 Electrical characteristics (curves)

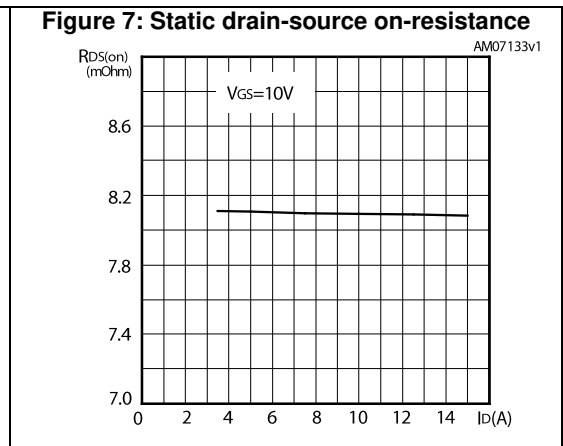
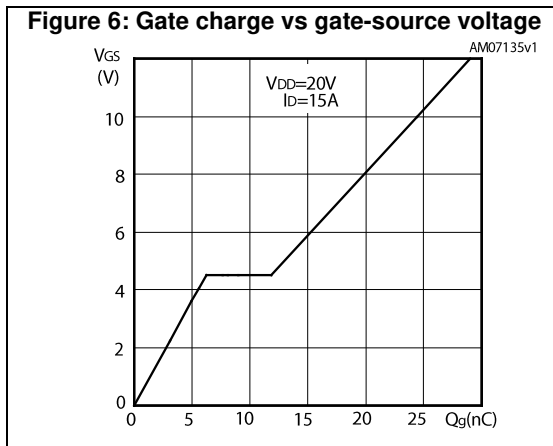
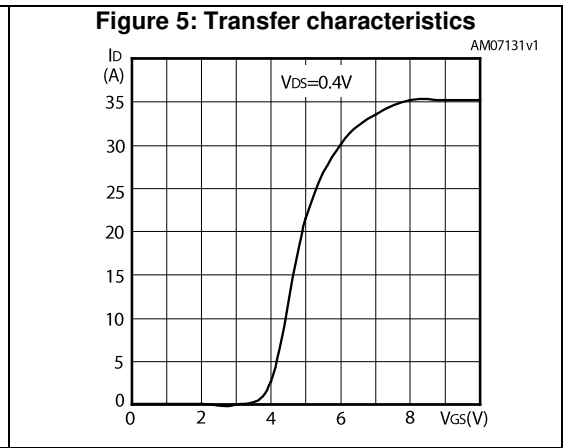
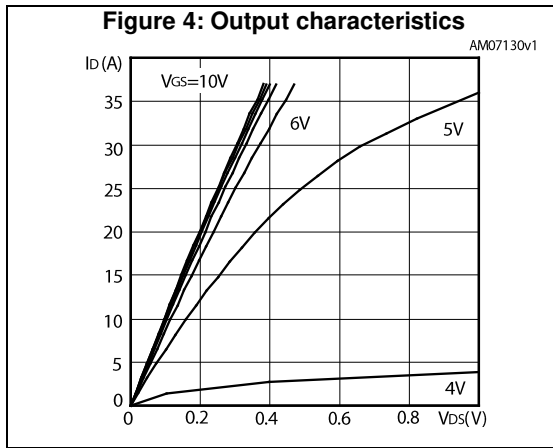
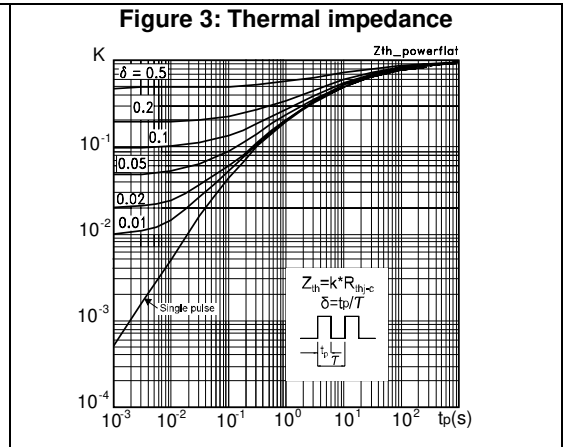
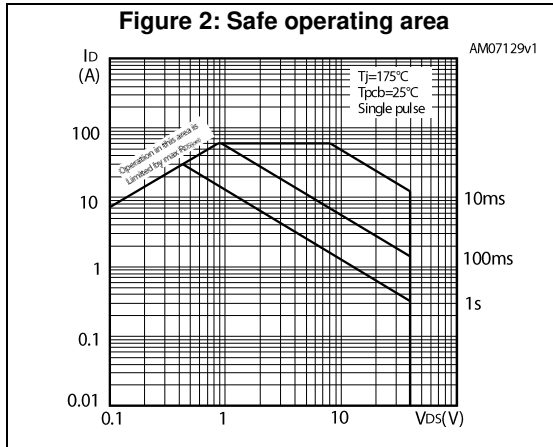


Figure 8: Capacitance variations

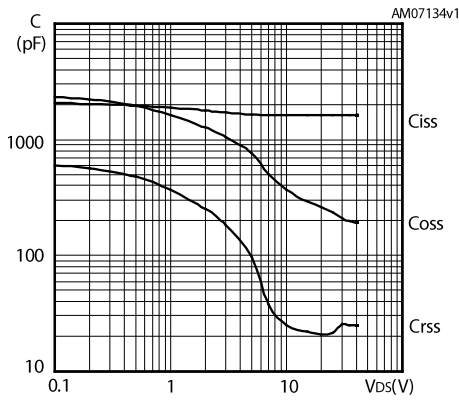


Figure 9: Normalized gate threshold voltage vs temperature

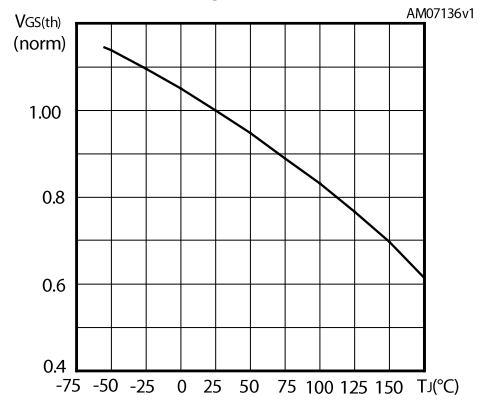


Figure 10: Normalized on-resistance vs temperature

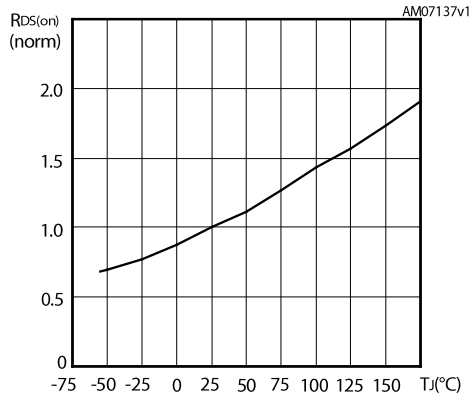


Figure 11: Normalized V(BR)DSS vs temperature

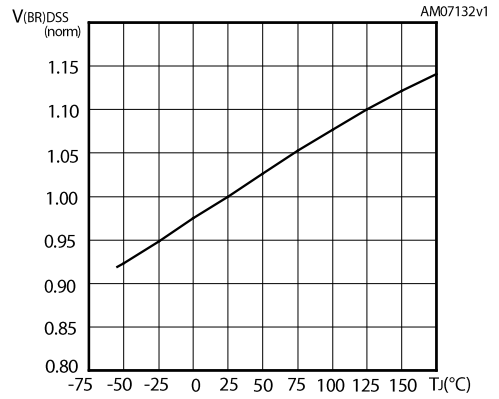
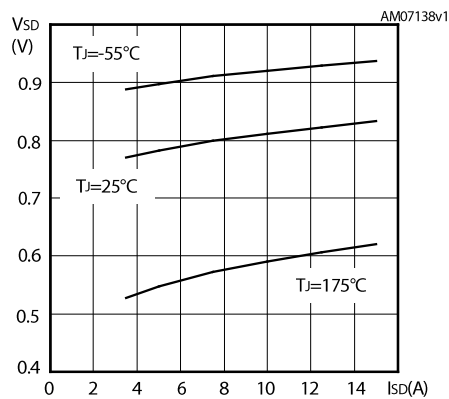


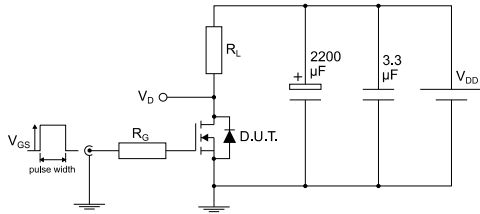
Figure 12: Source-drain diode forward characteristics





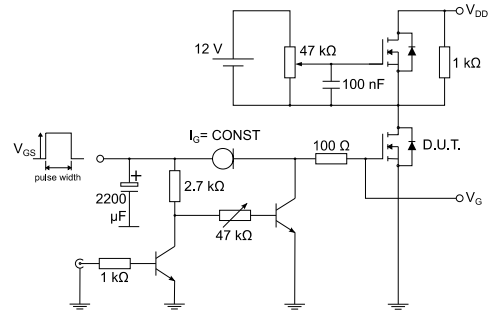
### 3 Test circuits

**Figure 13: Test circuit for resistive load switching times**



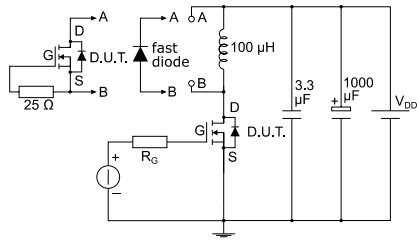
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**Figure 14: Test circuit for gate charge behavior**



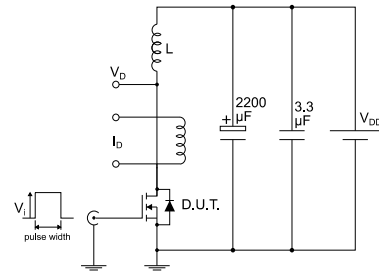
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**Figure 15: Test circuit for inductive load switching and diode recovery times**



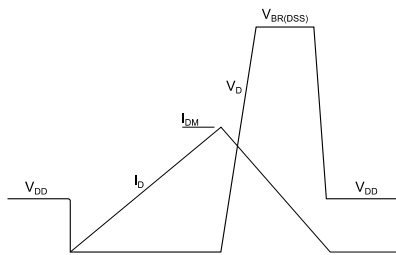
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**Figure 16: Unclamped inductive load test circuit**



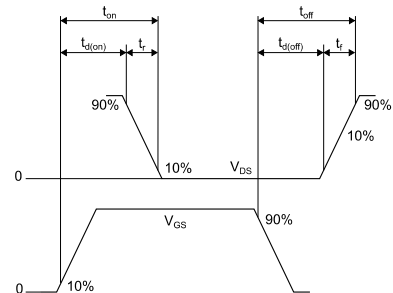
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**Figure 17: Unclamped inductive waveform**



AM01472v1

**Figure 18: Switching time waveform**



AM01473v1

## 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](http://www.st.com). ECOPACK® is an ST trademark.

### 4.1 PowerFLAT 5x6 double island WF type C package information

Figure 19: PowerFLAT™ 5x6 double island WF type C package outline

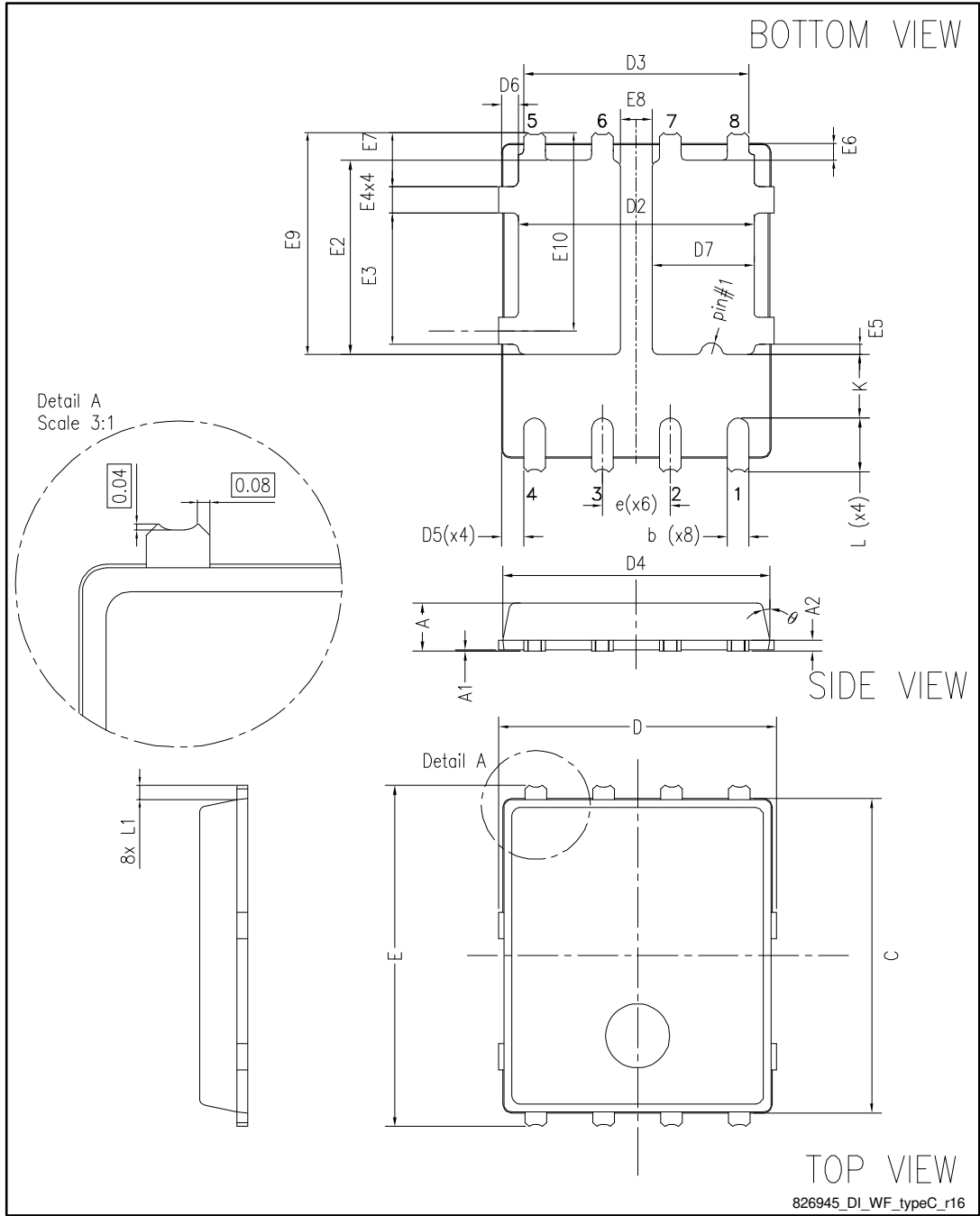
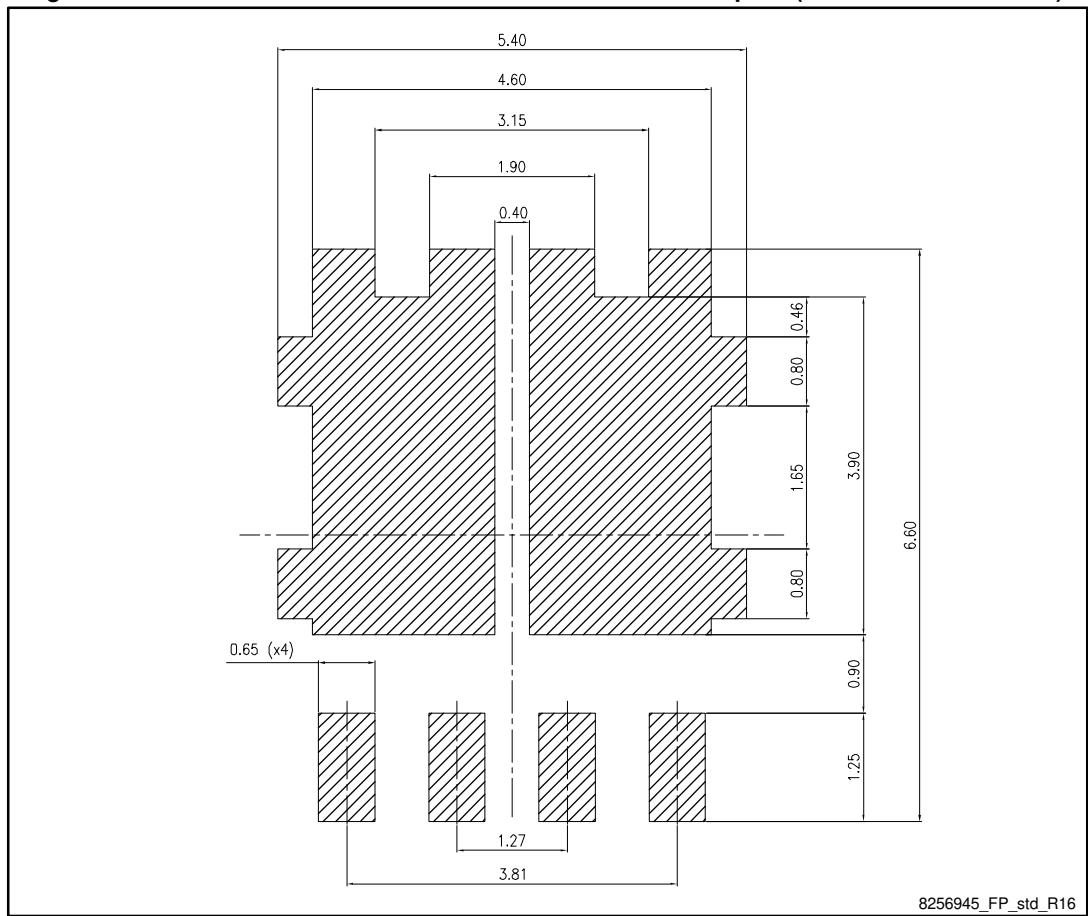


Table 9: PowerFLAT™ 5x6 double island WF type C mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
C	5.80	6.00	6.10
D	5.00	5.20	5.40
D2	4.15		4.45
D3	4.05	4.20	4.35
D4	4.80	5.00	5.10
D5	0.25	0.40	0.55
D6	0.15	0.30	0.45
D7	1.68		1.98
e		1.27	
E	6.20	6.40	6.60
E2	3.50		3.70
E3	2.35		2.55
E4	0.40		0.60
E5	0.08		0.28
E6	0.20	0.325	0.45
E7	0.85	1.00	1.15
E8	0.55		0.75
E9	4.00	4.20	4.40
E10	3.55	3.70	3.85
L	0.90	1.00	1.10
L1	0.175	0.275	0.375
K	1.05		1.35
Θ	0°		12°

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



## 4.2 Packing information

Figure 21: PowerFLAT™ 5x6 WF tape (dimensions are in mm)

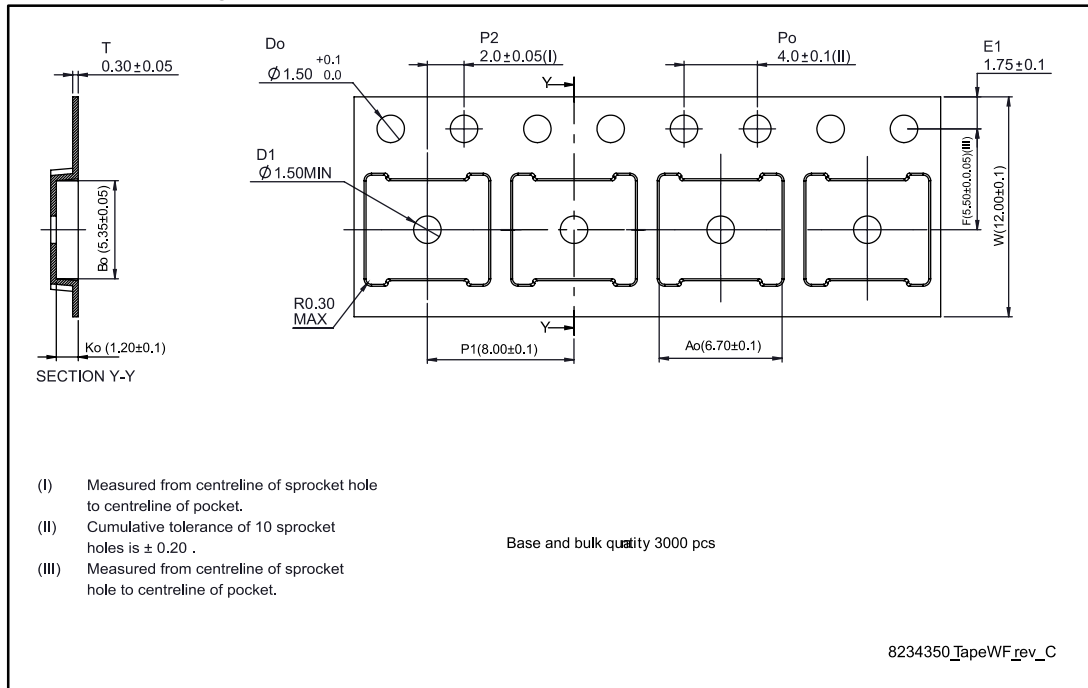


Figure 22: PowerFLAT™ 5x6 package orientation in carrier tape

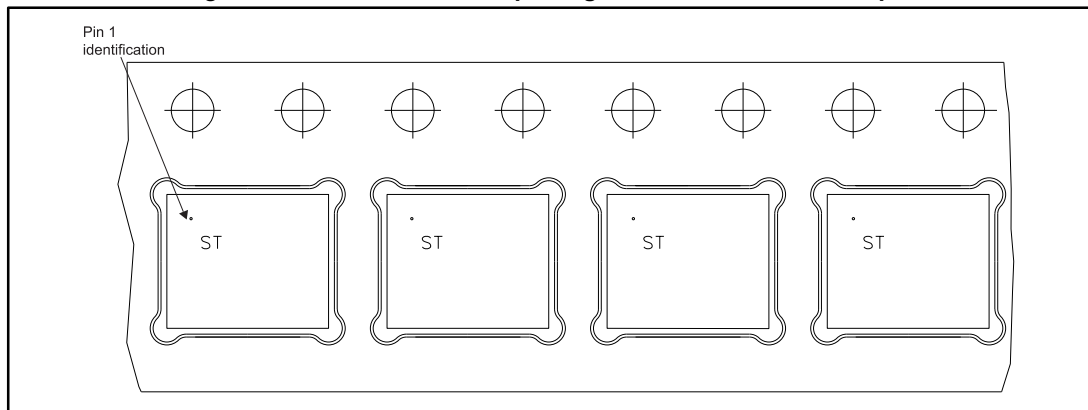
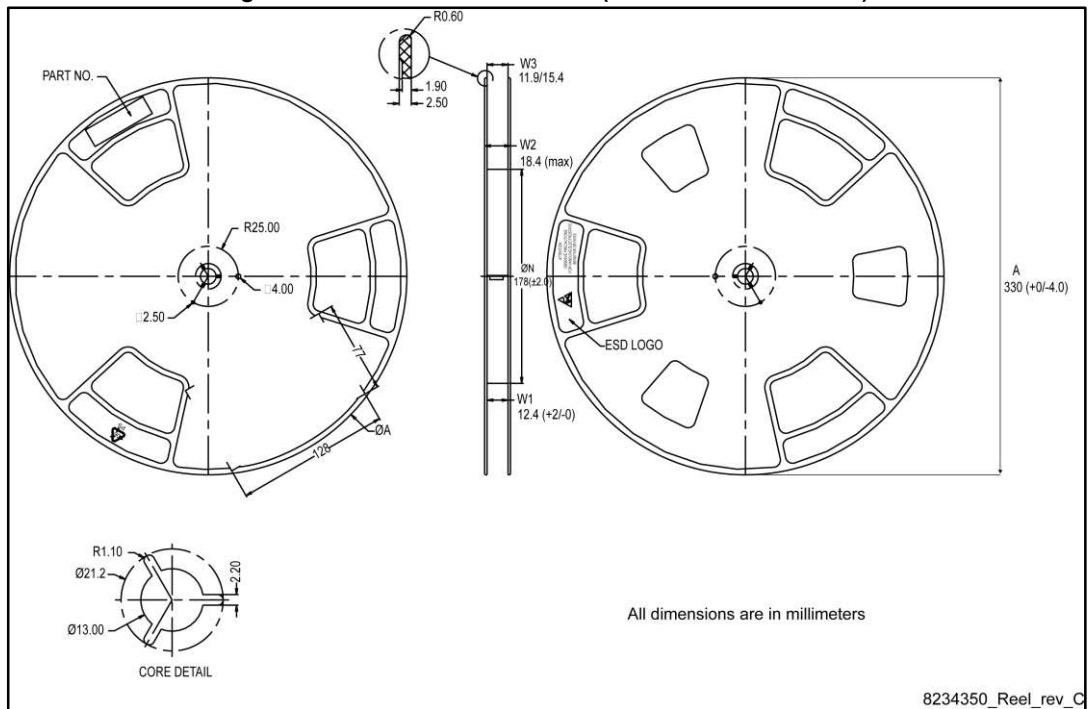


Figure 23: PowerFLAT™ 5x6 reel (dimensions are in mm)



## 5 Revision history

Table 10: Document revision history

Date	Revision	Changes
02-Sep-2010	1	First release.
01-Jul-2014	2	Updated: <i>Section 4: Package information</i> . Minor text changes
13-Feb-2015	3	Updated <i>Section 4: Package information</i> . Added <i>Section 5: Packaging information</i>
06-Jul-2016	4	Updated: <i>Section 6.1: "PowerFLAT 5x6 double island WF type C package information"</i> . Minor text changes.



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