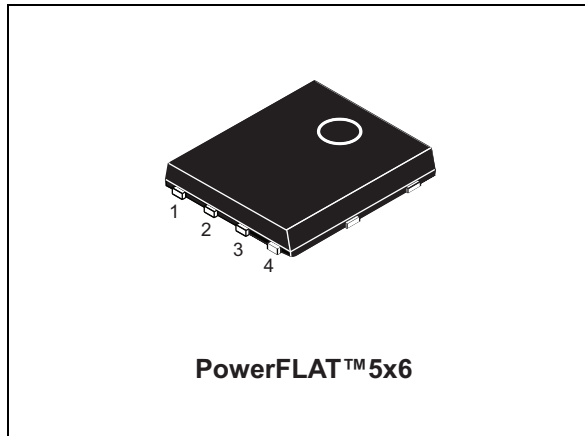
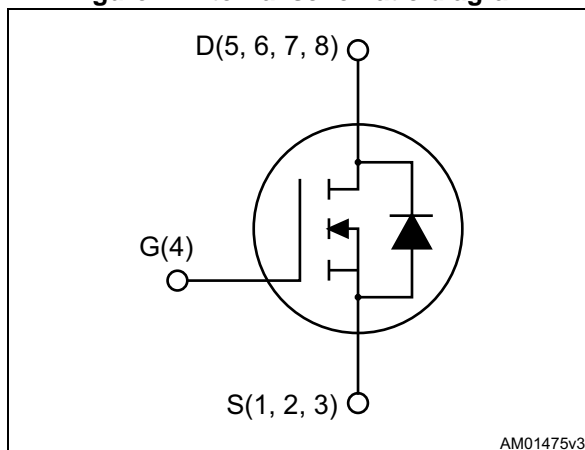


## N-channel 30 V, 0.0011 $\Omega$ typ., 45 A STripFET™ H6 Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet – production data



**Figure 1. Internal schematic diagram**



### Features

Order code	$V_{DS}$	$R_{DS(on) max}$	$I_D$
STL160N3LLH6	30 V	0.0013 $\Omega$	45 A <sup>(1)</sup>

1. The value is rated according to  $R_{thj-pcb}$

- Very low on-resistance
- Very low switching gate charge
- High avalanche ruggedness
- Low gate drive power loss

### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using the 6<sup>th</sup> generation of STripFET™ technology, with a new trench gate structure. The resulting Power MOSFET exhibits a very low  $R_{DS(on)}$  in all packages.

**Table 1. Device summary**

Order code	Marking	Package	Packaging
STL160N3LLH6	160N3LH6	PowerFLAT™ 5x6	Tape and reel

# Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	30	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	240	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	170	A
$I_{DM}^{(1),(3)}$	Drain current (pulsed)	960	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	45	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb}=100\text{ }^\circ\text{C}$	32	A
$I_{DM}^{(2),(3)}$	Drain current (pulsed)	180	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	136	W
$P_{TOT}^{(2)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	4.8	W
$T_j$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 175	$^\circ\text{C}$

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

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	1.1	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	31.3	$^\circ\text{C}/\text{W}$

1. When mounted on FR-4 board of 1inch<sup>2</sup>, 2oz Cu,  $t < 10$  sec.

**Table 4. Avalanche data**

Symbol	Parameter	Value	Unit
$I_{AV}$	Not-repetitive avalanche current (pulse width limited by $T_j$ max)	35	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AV}$ )	900	mJ

## 2 Electrical characteristics

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

**Table 5. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 250\ \mu\text{A}$	30			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 30\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 30\text{ V}$ at $T_C = 125\text{ °C}$			10	$\mu\text{A}$
$I_{GSS}$	Gate body leakage current	$V_{DS} = 0, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1			V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 17.5\text{ A}$		0.0011	0.0013	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 17.5\text{ A}$		0.0016	0.0020	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{GS} = 0, V_{DS} = 25\text{ V},$ $f = 1\text{ MHz}$	-	6375	-	pF
$C_{oss}$	Output capacitance		-	1230	-	pF
$C_{rss}$	Reverse transfer capacitance		-	675	-	pF
$Q_g$	Total gate charge	$V_{DD} = 15\text{ V}, I_D = 35\text{ A}$	-	61.5	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 4.5\text{ V}$	-	20	-	nC
$Q_{gd}$	Gate-drain charge	(see Figure 14)	-	24	-	nC
$R_g$	Gate input resistance	$f = 1\text{ MHz},$ gate DC Bias = 0, test signal level = 20 mV, $I_D = 0$	-	1.4	-	$\Omega$

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 15\text{ V}, I_D = 17.5\text{ A},$ $R_G = 4.7\ \Omega, V_{GS} = 10\text{ V}$ (see Figure 13)	-	22.5	-	ns
$t_r$	Rise time		-	32	-	ns
$t_{d(off)}$	Turn-off delay time		-	107.5	-	ns
$t_f$	Fall time		-	54	-	ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		45	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		180	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS}=0, I_{SD} = 35 \text{ A}$	-		1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 35 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD}=25 \text{ V}$	-	37.2		ns
$Q_{rr}$	Reverse recovery charge		-	36		nC
$I_{RRM}$	Reverse recovery current		-	1.9		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

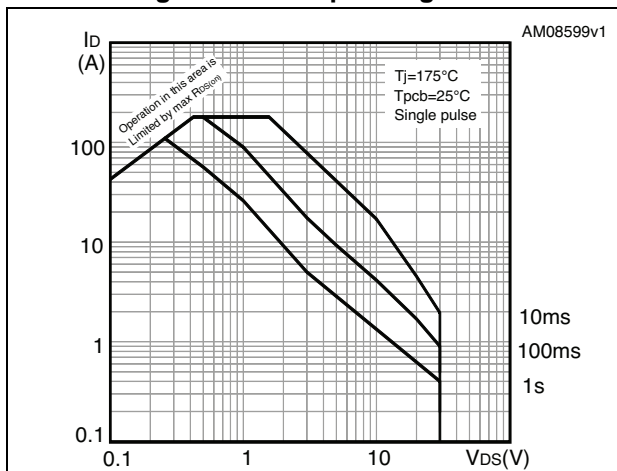


Figure 3. Thermal impedance

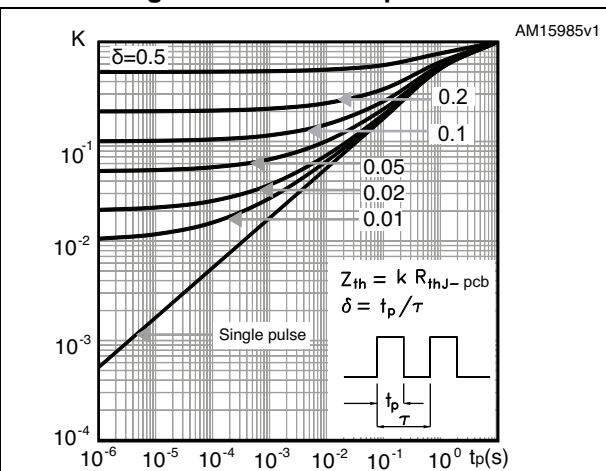


Figure 4. Output characteristics

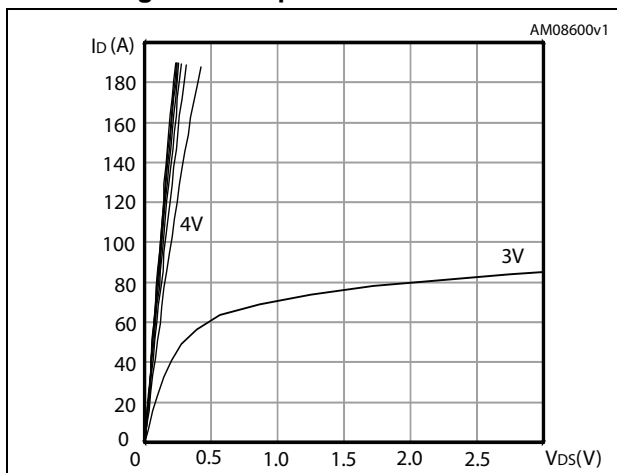


Figure 5. Transfer characteristics

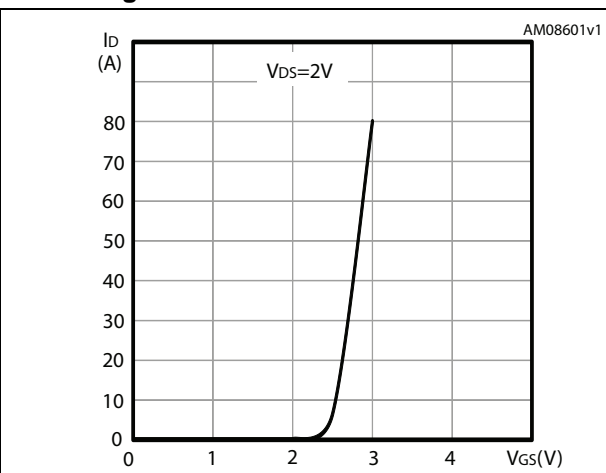


Figure 6. Normalized  $V_{(BR)DSS}$  vs temperature

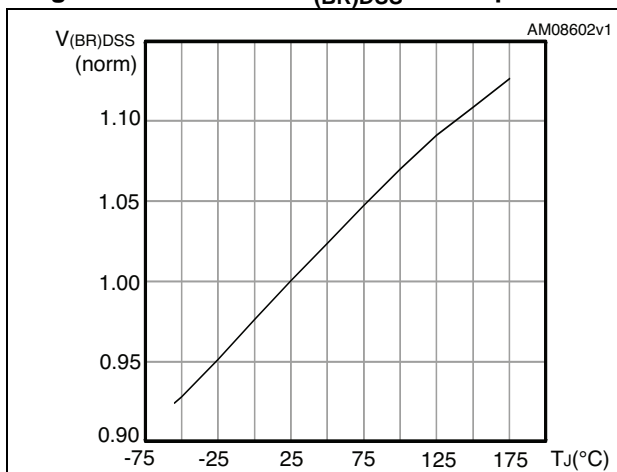


Figure 7. Static drain-source on-resistance

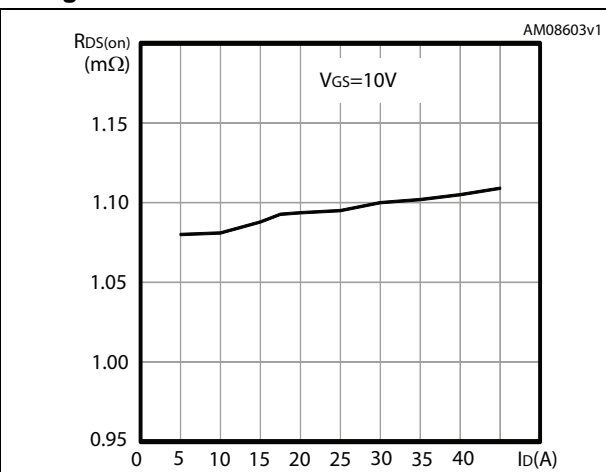


Figure 8. Gate charge vs gate-source voltage

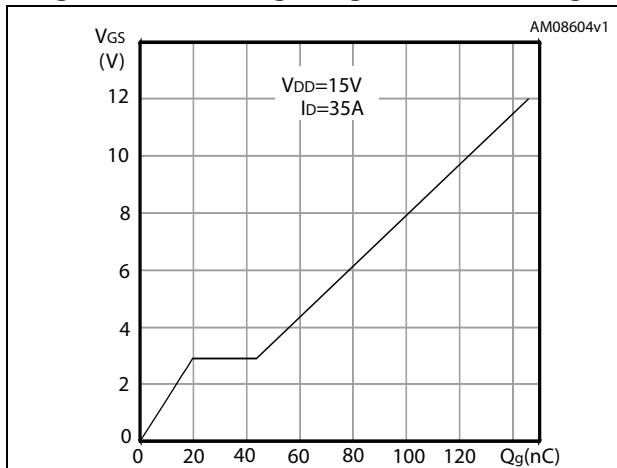


Figure 9. Capacitance variations

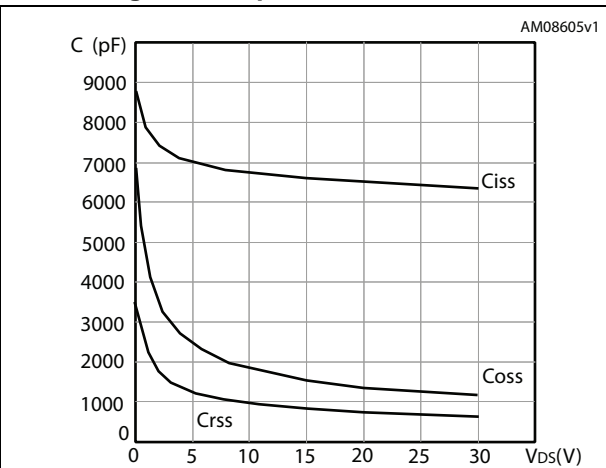


Figure 10. Normalized gate threshold voltage vs temperature

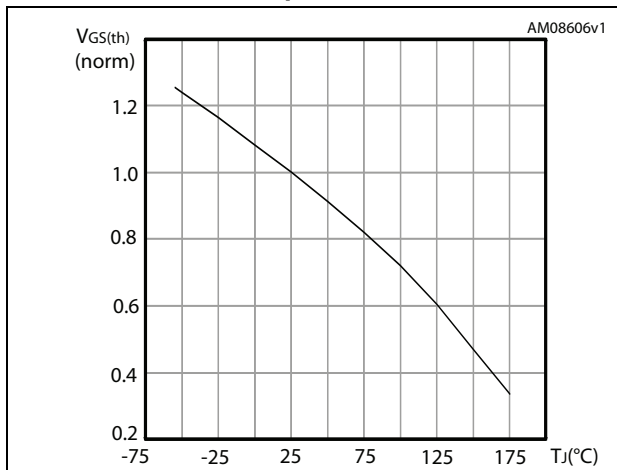


Figure 11. Normalized on-resistance vs temperature

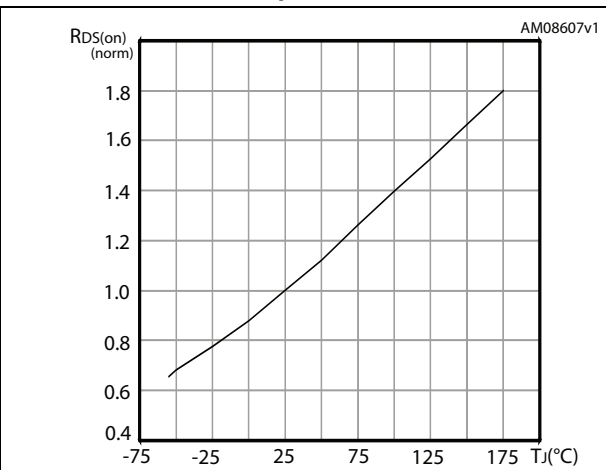
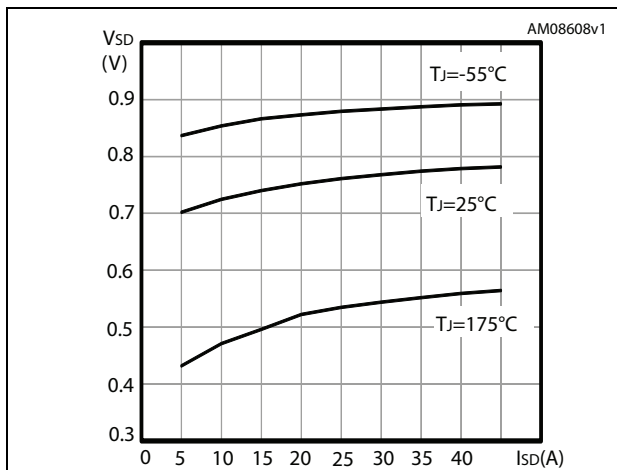


Figure 12. Source-drain diode forward characteristics



### 3 Test circuits

**Figure 13. Switching times test circuit for resistive load**



AM01468v1

**Figure 14. Gate charge test circuit**



AM01469v1

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



AM01470v1

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



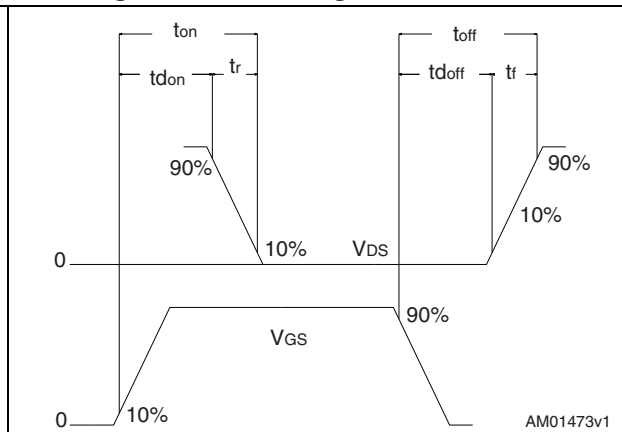
AM01471v1

**Figure 17. Unclamped inductive waveform**



AM01472v1

**Figure 18. Switching time waveform**



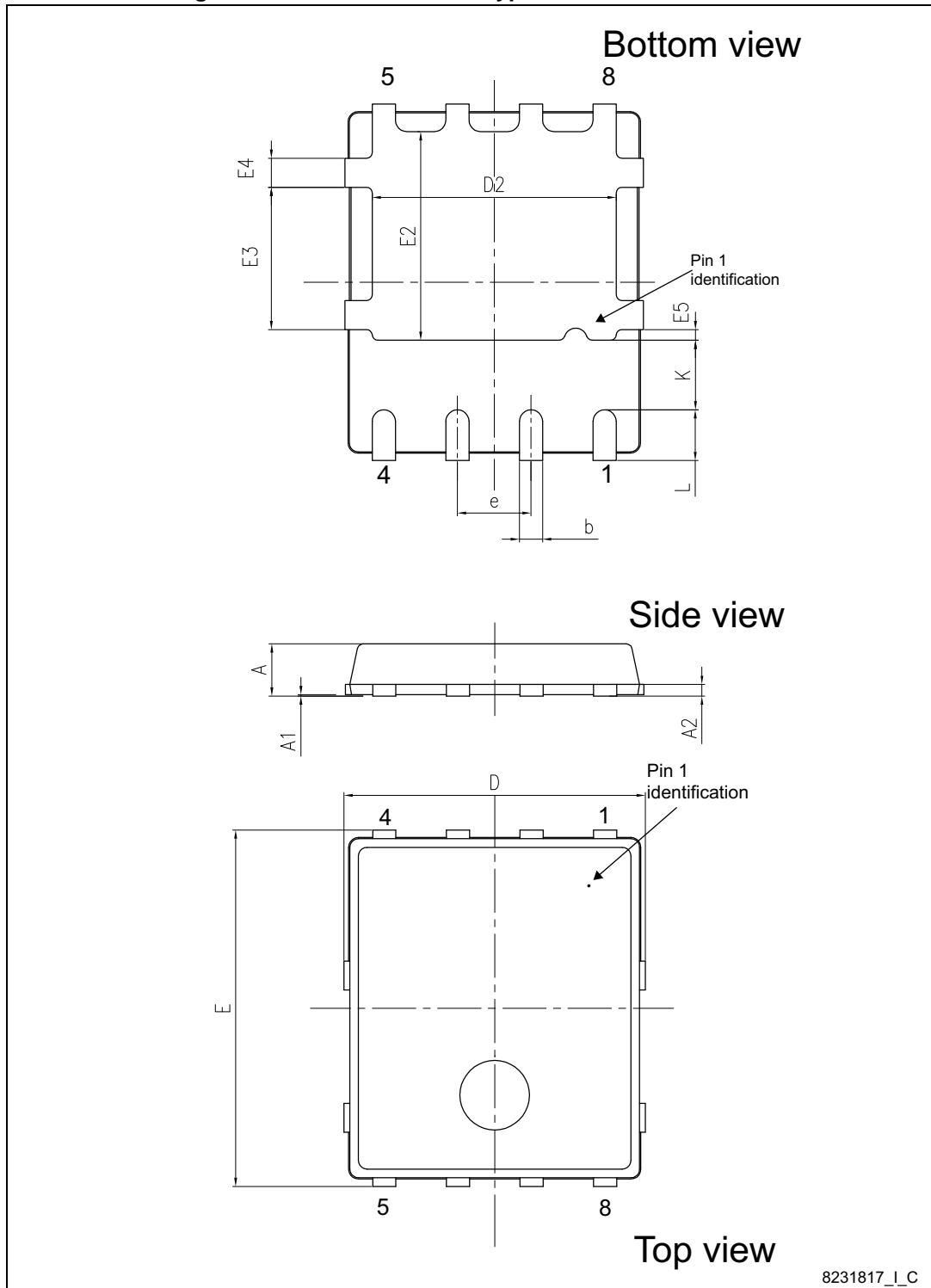
AM01473v1



## 4 Package mechanical data

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<sup>®</sup> is an ST trademark.

Figure 19. PowerFLAT™ 5x6 type S-C mechanical data

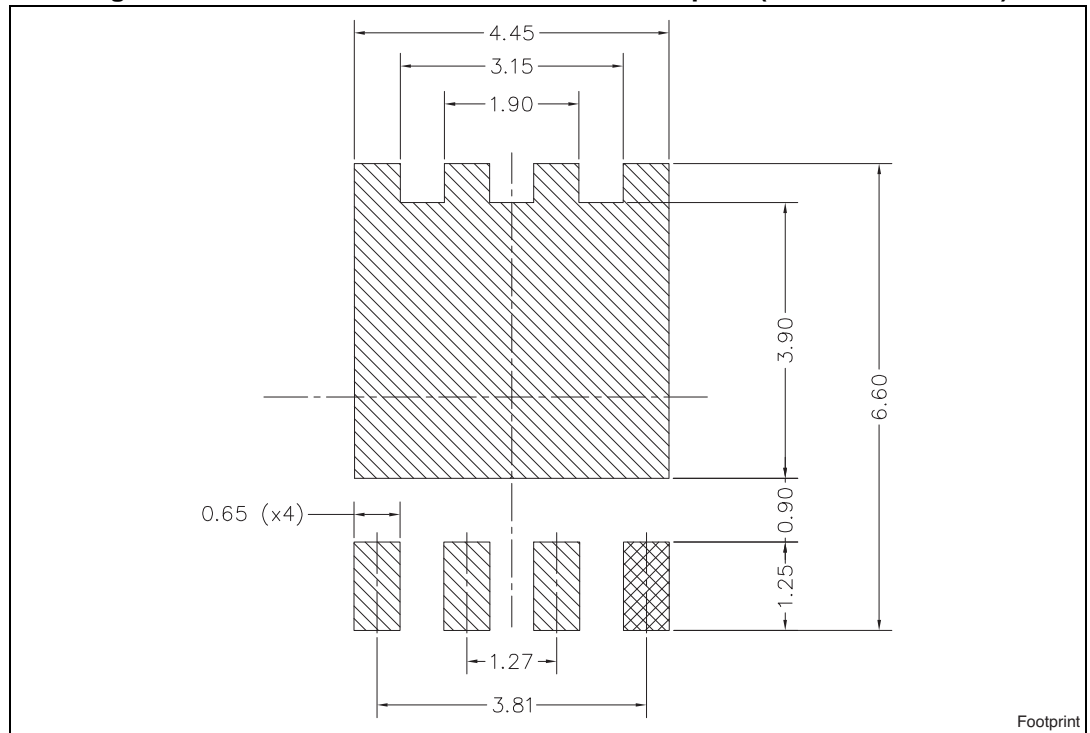


8231817\_I\_C

Table 9. PowerFLAT™ 5x6 type S-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
D		5.20	
E		6.15	
D2	4.11		4.31
E2	3.50		3.70
e		1.27	
e1		0.65	
L	0.715		1.015
K	1.05		1.35
E3	2.35		2.55
E4	0.40		0.60
E5	0.08		0.28

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



# 5 Packaging mechanical data

Figure 21. PowerFLAT™ 5x6 tape(a)

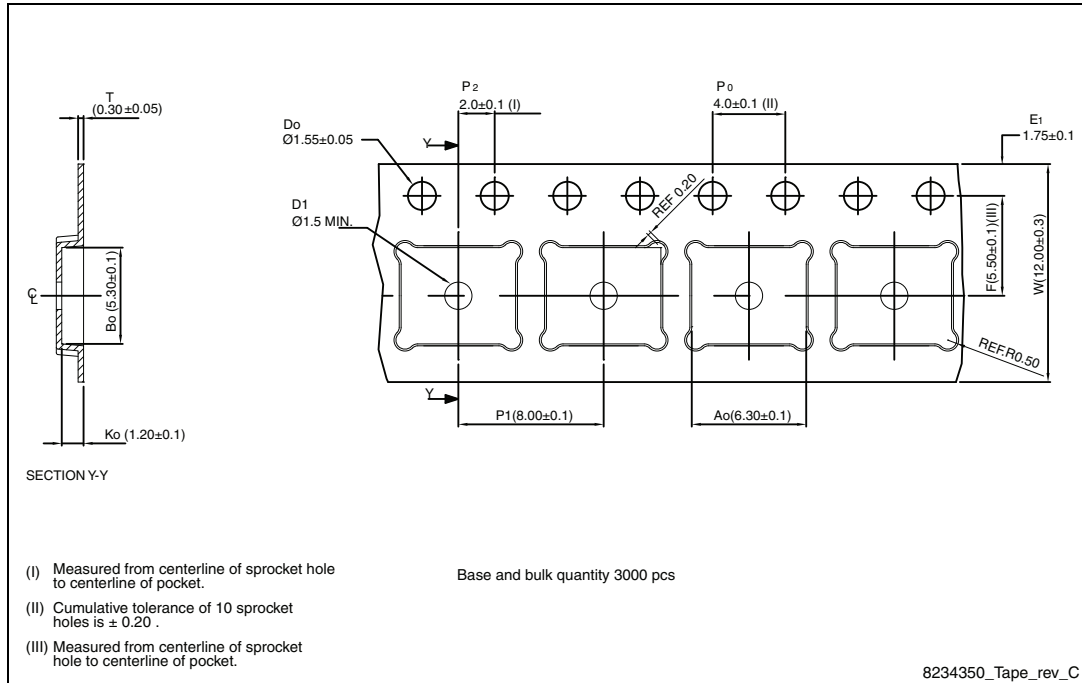
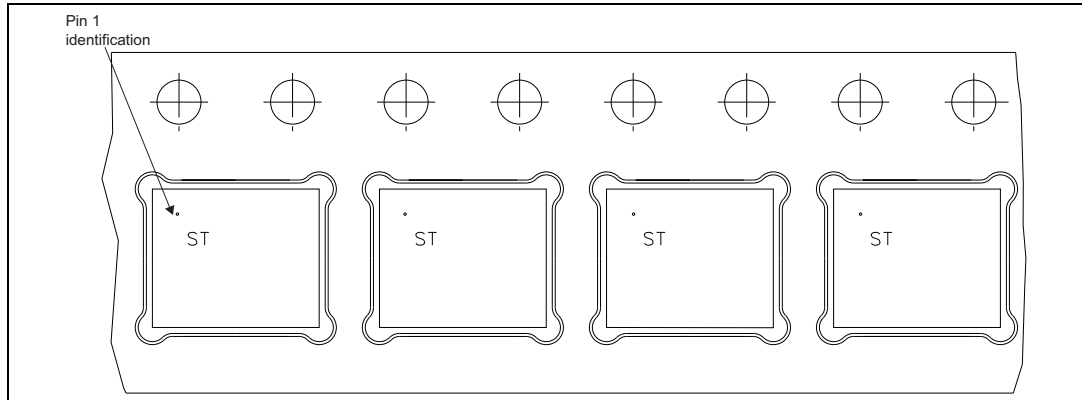
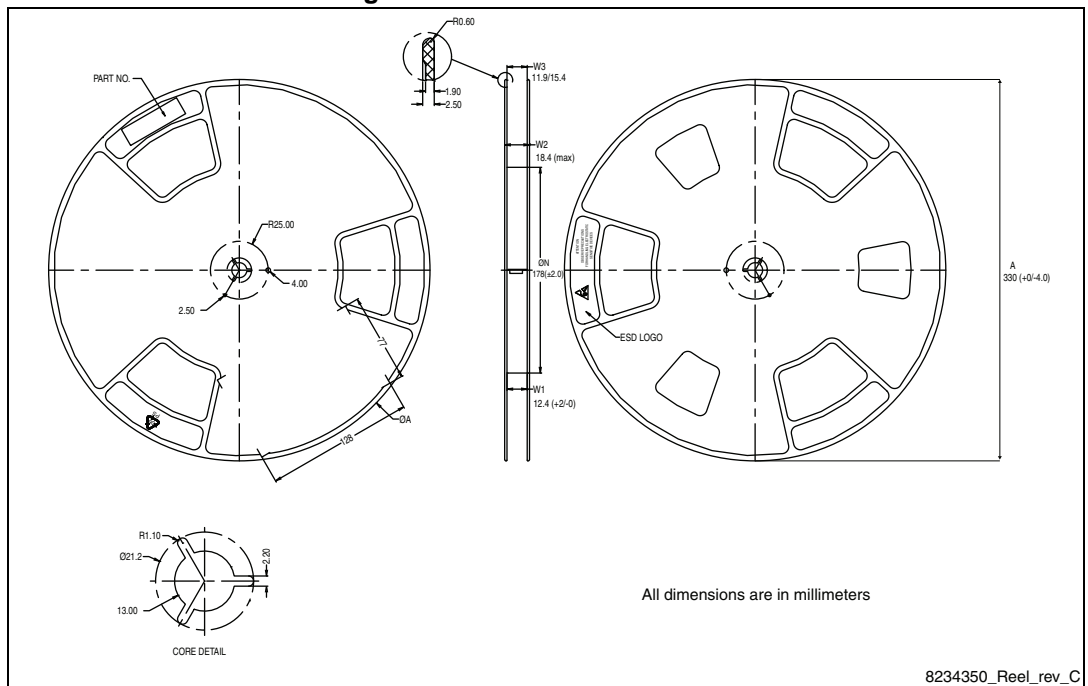


Figure 22. PowerFLAT™ 5x6 package orientation in carrier tape



a. All dimensions are in millimeters.

Figure 23. PowerFLAT™ 5x6 reel



## 6 Revision history

**Table 10. Document revision history**

Date	Revision	Changes
10-Nov-2010	1	First release.
10-Nov-2011	2	<a href="#">Section 4: Package mechanical data</a> has been updated. Minor text changes.
31-Jul-2013	3	<ul style="list-style-type: none"> <li>– Modified: <math>I_D</math> in the title and in the <a href="#">Features Table</a>, <a href="#">Table 5</a>, <a href="#">6</a> and <a href="#">7</a></li> <li>– Modified: values on the <a href="#">Table 2</a>, <math>R_{thj-case}</math> on the <a href="#">Table 3</a>, max values for the <math>I_{SD}</math> and <math>I_{SDM}</math> on <a href="#">Table 8</a></li> <li>– Updated: <a href="#">Section 4: Package mechanical data</a></li> <li>– Inserted: <a href="#">Section 5: Packaging mechanical data</a></li> <li>– Modified: <a href="#">Figure 13</a>, <a href="#">14</a>, <a href="#">15</a> and <a href="#">16</a></li> <li>– Minor text changes</li> </ul>
09-Aug-2013	4	<ul style="list-style-type: none"> <li>– Modified: drain current (continuous) at <math>T_C = 100\text{ °C}</math> value and drain current (continuous) at <math>T_{pcb}=100\text{ °C}</math> value</li> <li>– Modified: test conditions of <math>R_{DS(on)}</math></li> <li>– Modified: <math>I_D</math> in <a href="#">Table 6</a> and <a href="#">7</a></li> <li>– Modified: <math>I_{SD}</math> in <a href="#">Table 8</a></li> <li>– Modified: <a href="#">Figure 2</a>, <a href="#">3</a>, <a href="#">4</a>, <a href="#">5</a>, <a href="#">7</a>, <a href="#">12</a>, <a href="#">13</a>, <a href="#">14</a>, <a href="#">15</a> and <a href="#">16</a></li> <li>– Updated: <a href="#">Section 4: Package mechanical data</a></li> <li>– Minor text changes</li> </ul>
24-Sep-2013	5	<ul style="list-style-type: none"> <li>– Modified: marking in <a href="#">Table 1</a></li> <li>– Minor text changes</li> </ul>
23-Sep-2014	6	<ul style="list-style-type: none"> <li>– Modified: title</li> <li>– Modified: <a href="#">Features</a></li> <li>– Modified: <a href="#">Description</a></li> <li>– Updated: <a href="#">Section 4: Package mechanical data</a></li> <li>– Minor text changes</li> </ul>

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