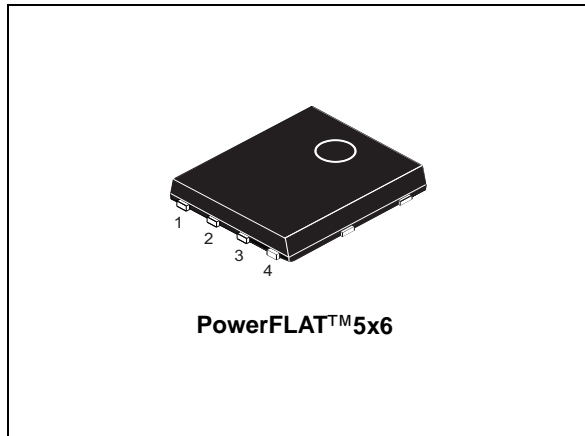


## N-channel 30 V, 0.0016 $\Omega$ typ., 160 A STripFET™ H7 Power MOSFET plus monolithic Schottky in a PowerFLAT™ 5x6

Datasheet - production data



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STL160NS3LLH7	30 V	0.0021 $\Omega$	160 A

- Very low on-resistance
- Very low Q<sub>g</sub>
- High avalanche ruggedness
- Embedded Schottky diode

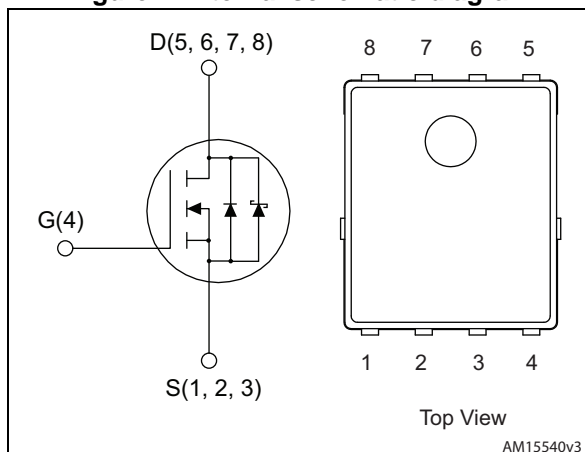
### Applications

- Switching applications

### Description

This device exhibits low on-state resistance and capacitance for improved conduction and switching performance.

**Figure 1. Internal schematic diagram**



**Table 1. Device summary**

Order code	Marking	Package	Packaging
STL160NS3LLH7	160NS3LL	PowerFLAT™ 5x6	Tape and reel

## Contents

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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 $T_C = 25\text{ }^\circ\text{C}$	160	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	115	A
$I_{DM}^{(1)(2)}$	Drain current (pulsed)	640	A
$I_D^{(3)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	36	A
$I_D^{(3)}$	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	26	A
$I_{DM}^{(2)(3)}$	Drain current (pulsed)	144	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	84	W
$P_{TOT}^{(3)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	4	W
$E_{AS}^{(4)}$	Single pulse avalanche energy	200	mJ
$T_j$	Operating junction temperature	-55 to 150	$^\circ\text{C}$
$T_{stg}$	Storage temperature		$^\circ\text{C}$

1. This value is rated according to  $R_{thj-c}$
2. Pulse width limited by safe operating area
3. This value is rated according to  $R_{thj-pcb}$
4.  $L=1\text{ mH}$ ,  $I_D=20\text{ A}$ ,  $V_{DD}=25\text{ V}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	31.3	$^\circ\text{C/W}$
$R_{thj-case}$	Thermal resistance junction-case max	1.5	$^\circ\text{C/W}$

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

## 2 Electrical characteristics

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

**Table 4. On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 1\text{ mA}$	30			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 24\text{ V}$			500	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 1\text{ mA}$	1.2		2.3	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 18\text{ A}$		0.0016	0.0021	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 18\text{ A}$		0.0025	0.0031	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{GS} = 0, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$	-	3245	-	pF
$C_{oss}$	Output capacitance		-	970	-	pF
$C_{riss}$	Reverse transfer capacitance		-	52	-	pF
$Q_g$	Total gate charge	$V_{DD} = 15\text{ V}, I_D = 36\text{ A},$ $V_{GS} = 4.5\text{ V}$ (see <a href="#">Figure 13</a> )	-	20	-	nC
$Q_{gs}$	Gate-source charge		-	9.3	-	nC
$Q_{gd}$	Gate-drain charge		-	5.7	-	nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 15\text{ V}, I_D = 18\text{ A},$ $R_G = 4.7\text{ }\Omega, V_{GS} = 4.5\text{ V}$	-	12.4	-	ns
$t_r$	Rise time		-	21.3	-	ns
$t_{d(off)}$	Turn-off delay time		-	50.7	-	ns
$t_f$	Fall time		-	19.5	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		120	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		480	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0, I_{SD} = 2 \text{ A}$	-	0.4	0.7	V
$t_{rr}$	Reverse recovery time	$V_{GS} = 0 \text{ V}, I_D = 36 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s}$	-	46		ns
$Q_{rr}$	Reverse recovery charge		-	46		nC
$I_{RRM}$	Reverse recovery current		-	2		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

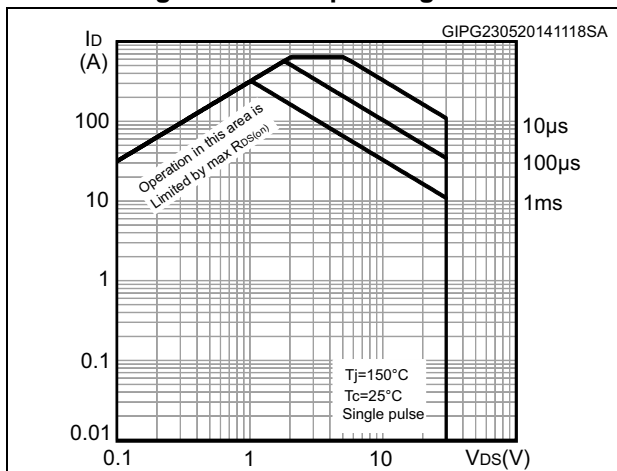


Figure 3. Thermal impedance

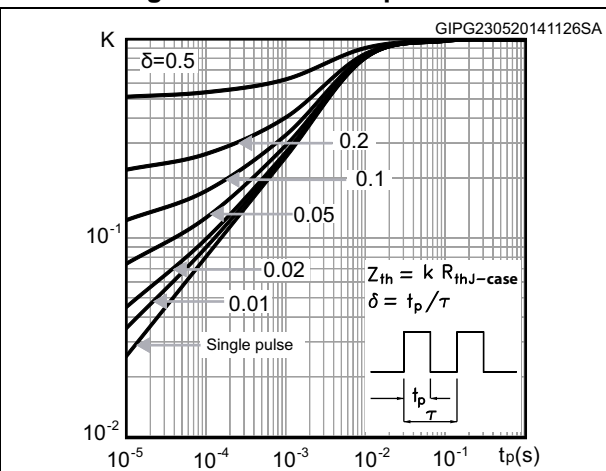


Figure 4. Output characteristics

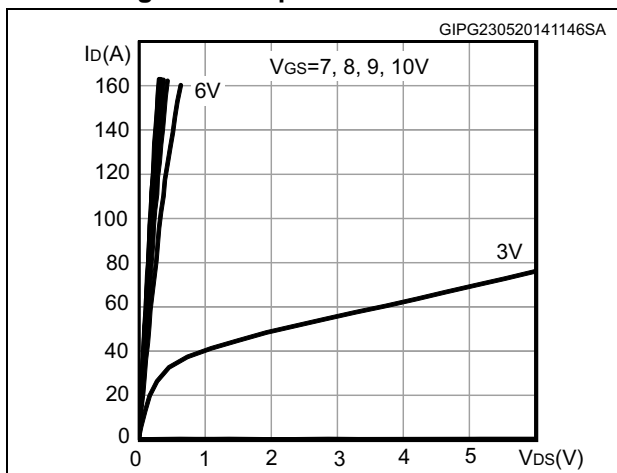


Figure 5. Transfer characteristics

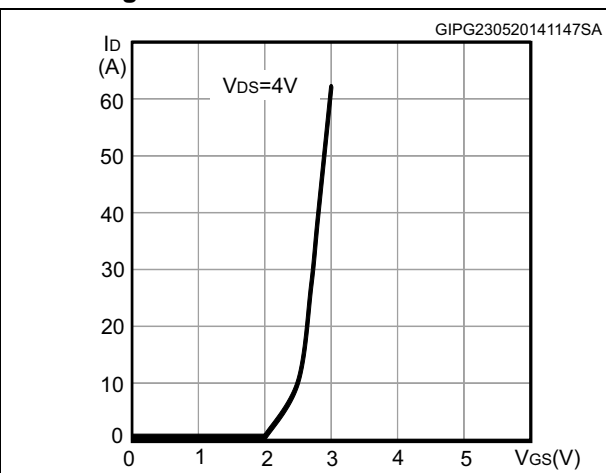


Figure 6. Gate charge vs gate-source voltage

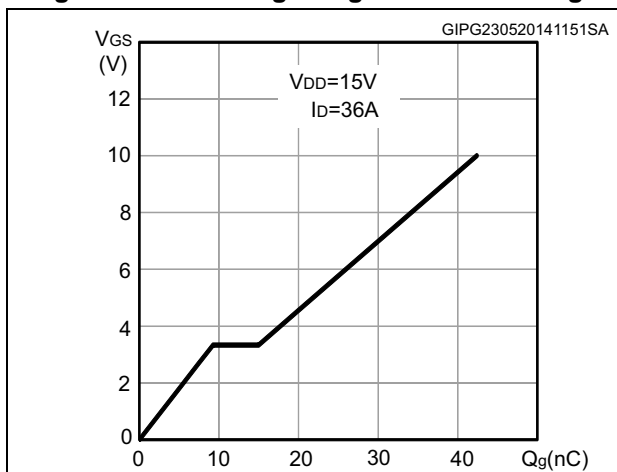


Figure 7. Static drain-source on-resistance

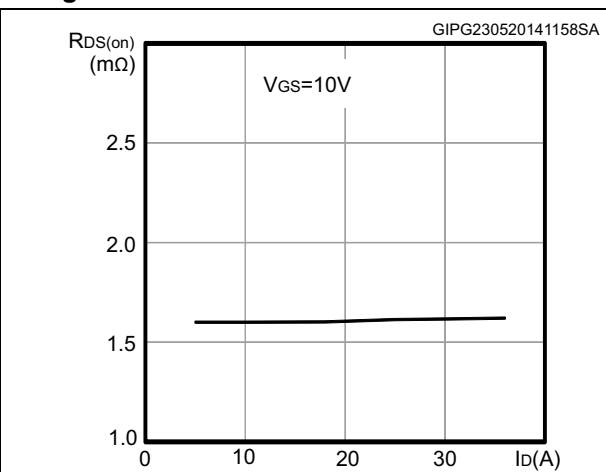


Figure 8. Capacitance variations

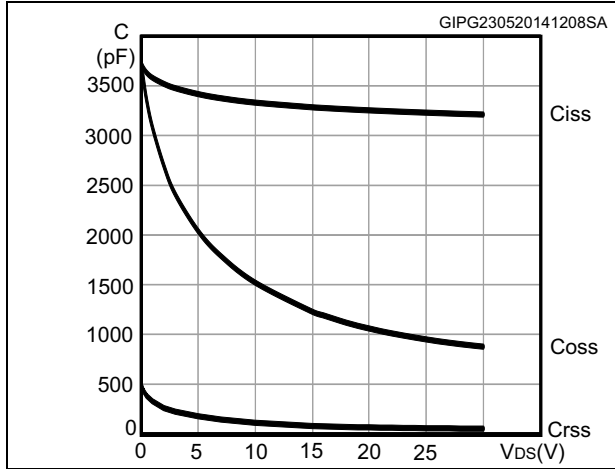


Figure 9. Normalized gate threshold voltage vs temperature

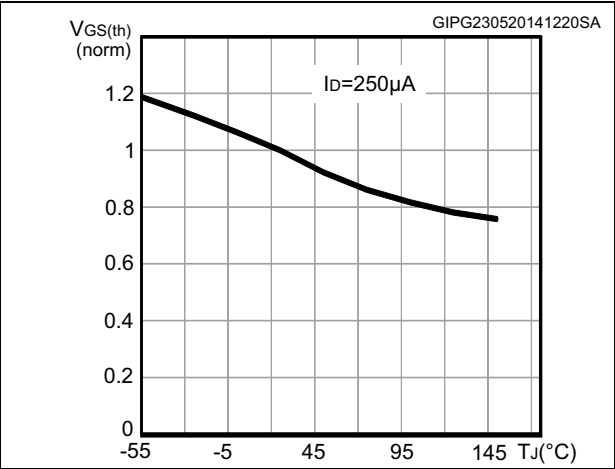


Figure 10. Normalized on-resistance vs temperature

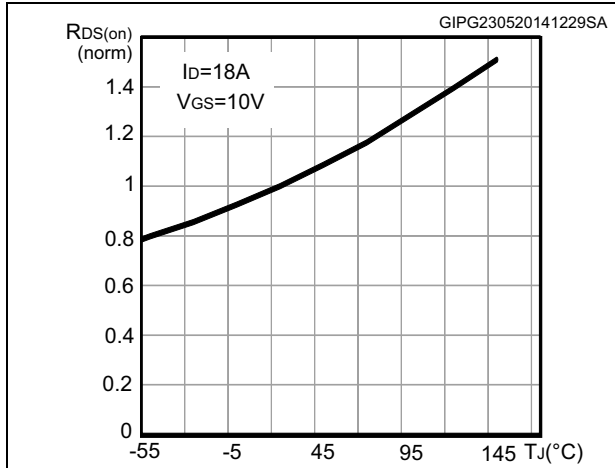
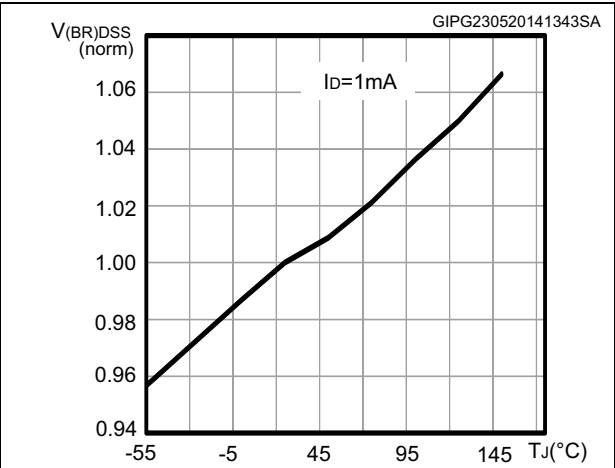


Figure 11. Normalized V<sub>(BR)DSS</sub> vs temperature



### 3 Test circuits

Figure 12. Switching times test circuit for resistive load



AM01468v1

Figure 13. Gate charge test circuit



AM01469v1

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



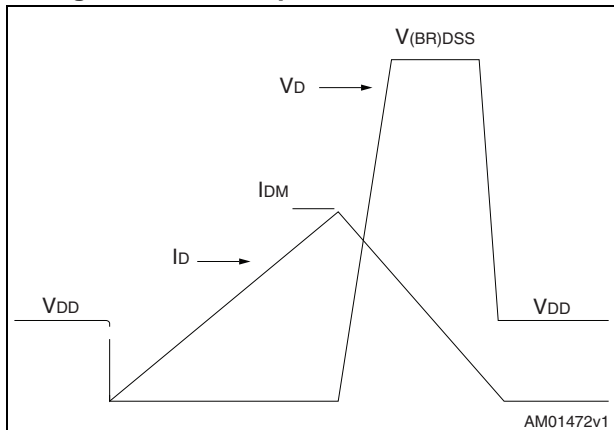
AM01470v1

Figure 15. Unclamped inductive load test circuit



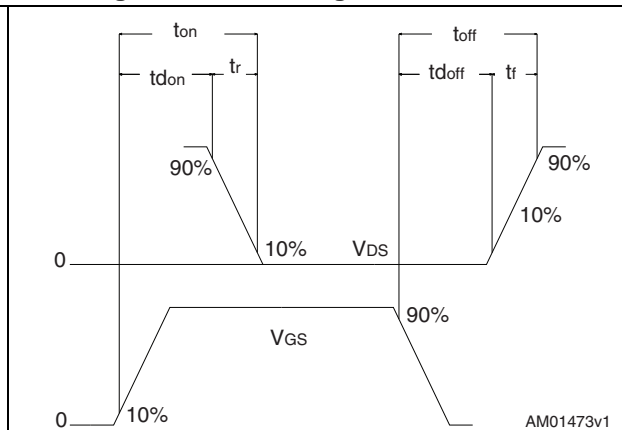
AM01471v1

Figure 16. Unclamped inductive waveform



AM01472v1

Figure 17. 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 18. PowerFLAT™ 5x6 type S-C mechanical data

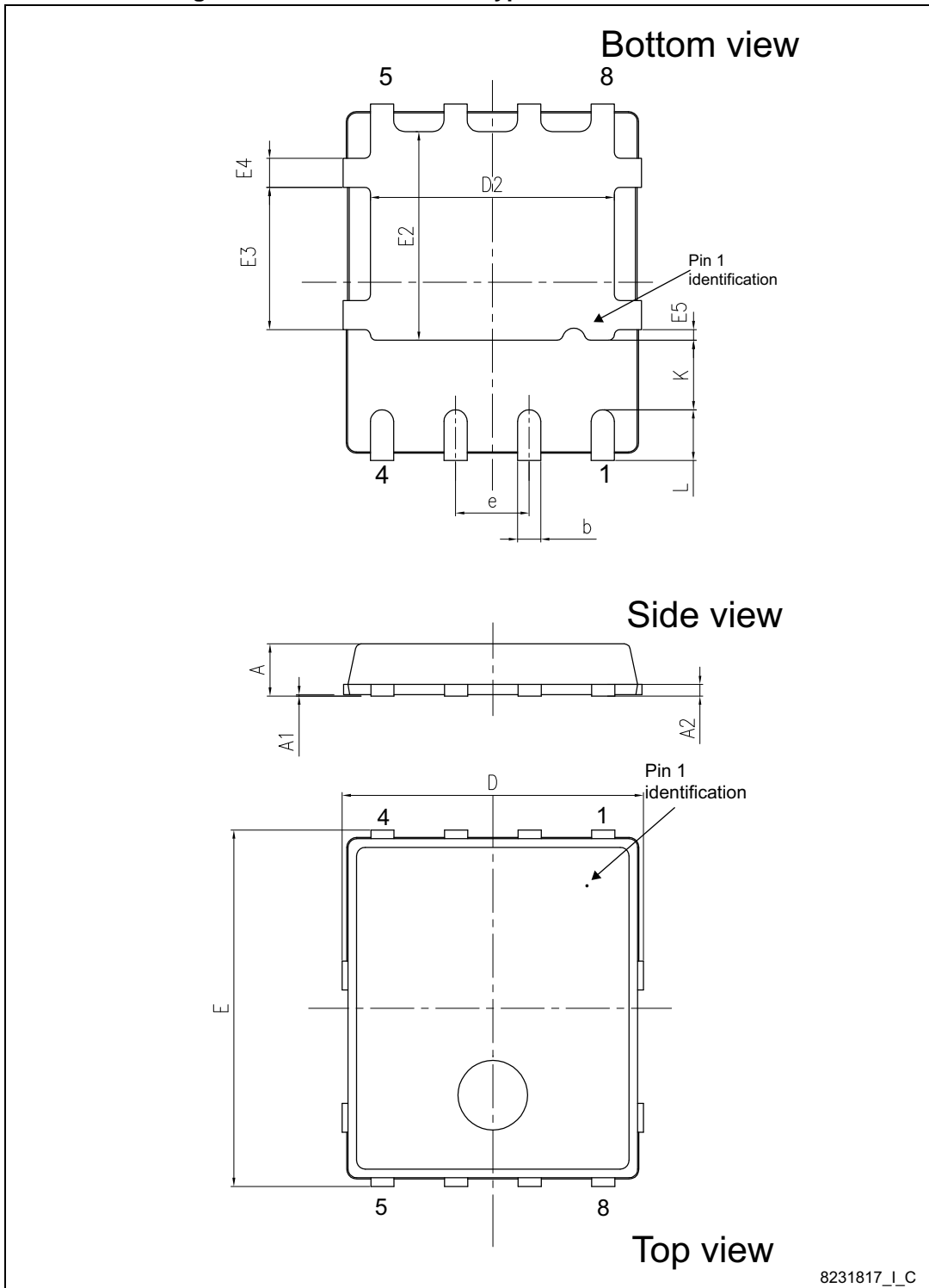
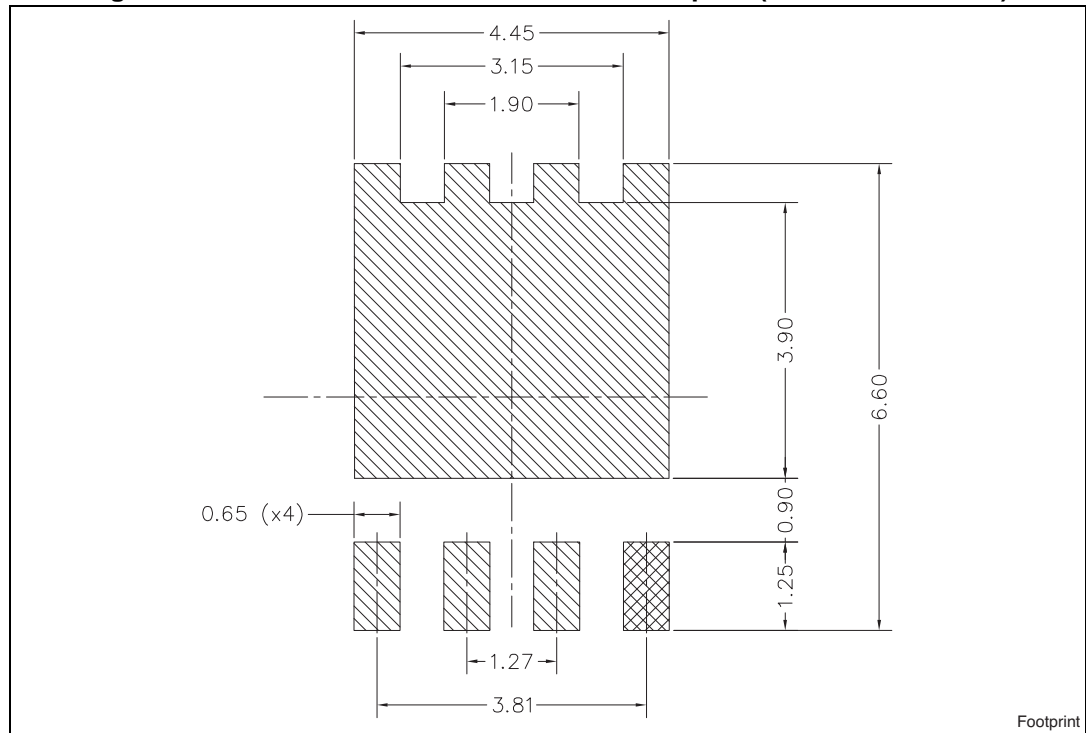


Table 8. PowerFLAT™ 5x6 type S-C mechanical data

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	
D2	4.11		4.31
E		6.15	
e		1.27	
e1		0.65	
E2	3.50		3.70
E3	2.35		2.55
E4	0.40		0.60
E5	0.08		0.28
K	1.05		1.35
L	0.715		1.015

Figure 19. PowerFLAT™ 5x6 recommended footprint (dimensions in mm)



# 5 Packaging mechanical data

Figure 20. PowerFLAT™ 5x6 tape<sup>(a)</sup>

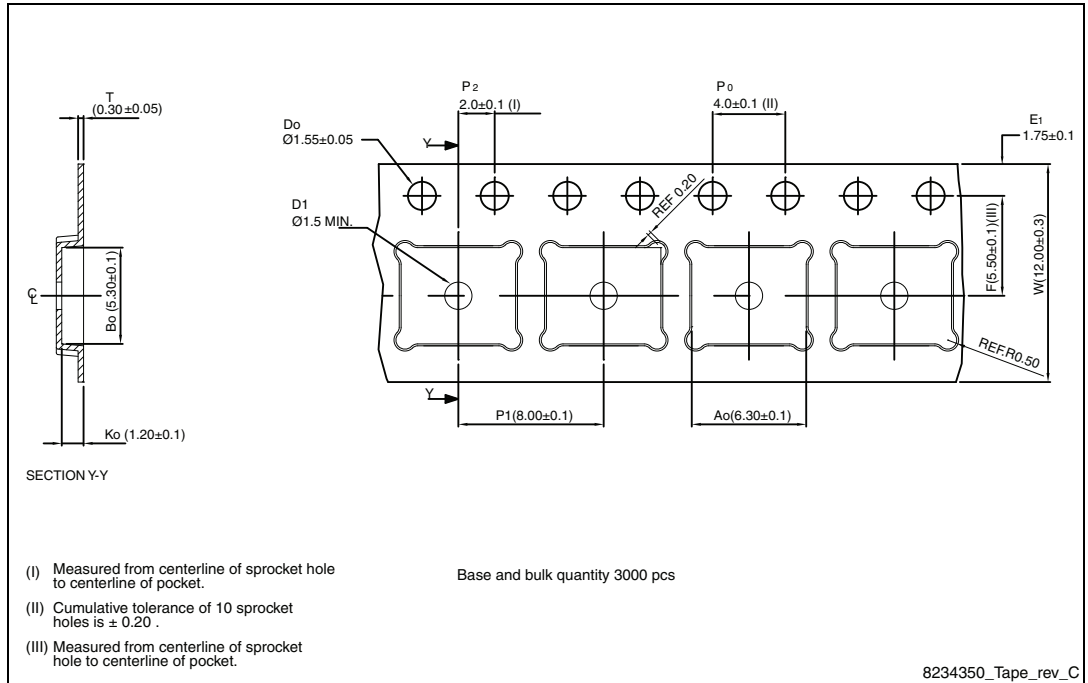
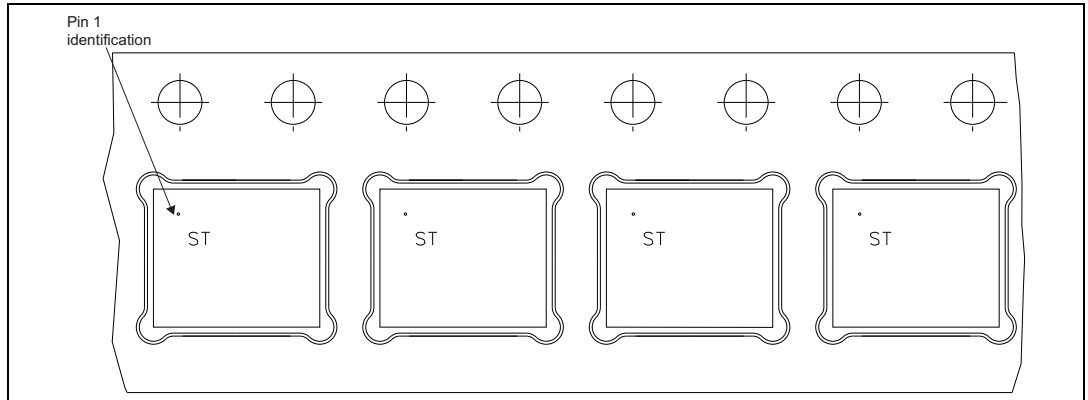
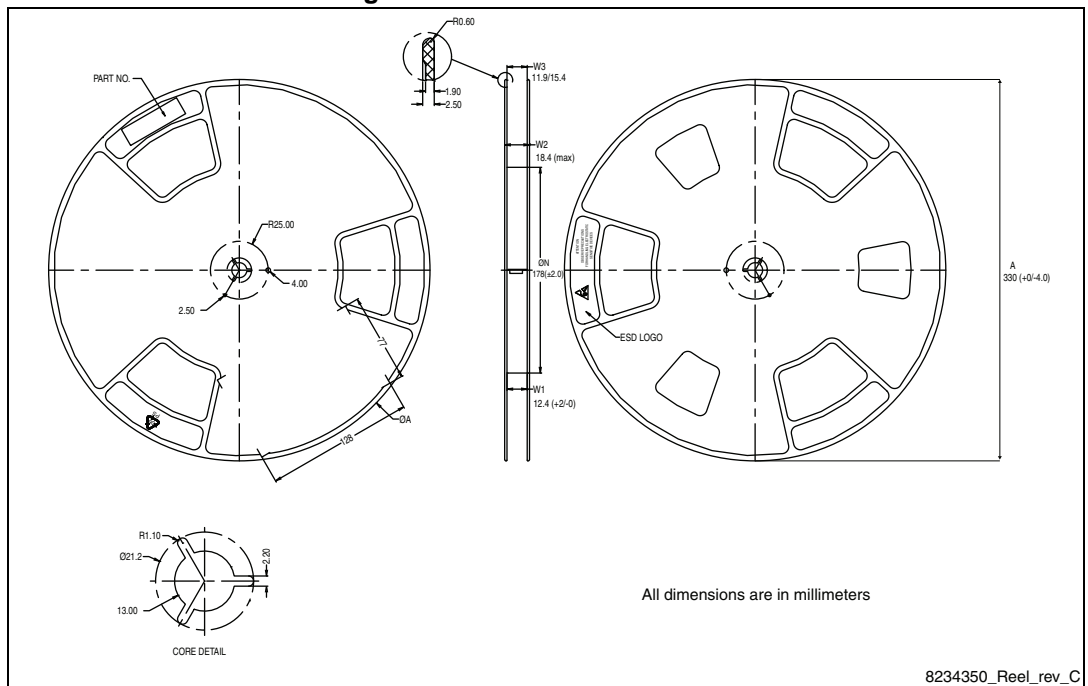


Figure 21. PowerFLAT™ 5x6 package orientation in carrier tape



a. All dimensions are in millimeters.

Figure 22. PowerFLAT™ 5x6 reel



## 6 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
11-Jun-2013	1	First release.
26-May-2014	2	<ul style="list-style-type: none"> <li>– Document status promoted from target to production data</li> <li>– Modified: <math>T_J</math> value in <a href="#">Table 2</a></li> <li>– Modified: the entire typical values in <a href="#">Table 5, 6, 7</a></li> <li>– Added: <a href="#">Section 2.1: Electrical characteristics (curves)</a></li> <li>– Updated: <a href="#">Section 4: Package mechanical data</a></li> <li>– Minor text changes</li> </ul>
18-Jun-2014	3	<ul style="list-style-type: none"> <li>– Added: <math>E_{AS}</math> value in <a href="#">Table 2</a></li> <li>– Updated: <a href="#">Section 4: Package mechanical data</a></li> <li>– Minor text changes</li> </ul>
24-Jul-2014	4	<ul style="list-style-type: none"> <li>– Modified: title and features</li> <li>– Modified: <math>P_{TOT}</math> values in <a href="#">Table 2</a></li> <li>– Modified: <math>I_{SD}</math> and <math>I_{SDM}</math> max values in <a href="#">Table 7</a></li> <li>– Minor text changes</li> </ul>

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