

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

Datasheet – production data

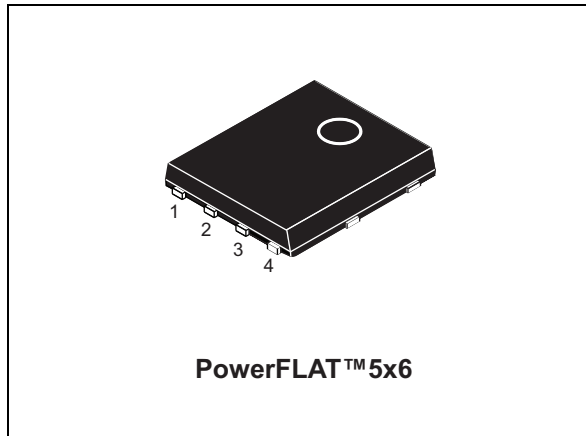
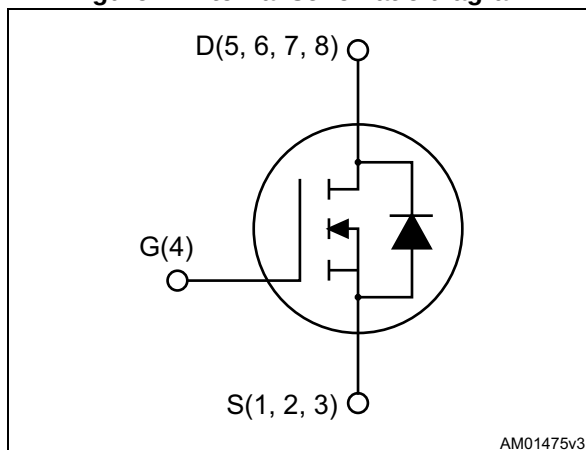


Figure 1. Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max	I_D
STL160N3LLH6	30 V	0.0013 Ω	45 A ⁽¹⁾

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 6th 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

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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	± 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	$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	31.3	$^\circ\text{C/W}$

1. When mounted on FR-4 board of 1inch², 2oz Cu, $t < 10\text{ sec}$.

Table 4. Avalanche data

Symbol	Parameter	Value	Unit
I_{AV}	Not-repetitive avalanche current (pulse width limited by $T_j\text{ max}$)	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	$V_{GS} = 0, I_D = 250\text{ }\mu\text{A}$	30			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 30\text{ V}$			1	μA
		$V_{DS} = 30\text{ V}$ at $T_C = 125\text{ °C}$			10	μA
I_{GSS}	Gate body leakage current	$V_{DS} = 0, V_{GS} = \pm 20\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	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	Ω
		$V_{GS} = 4.5\text{ V}, I_D = 17.5\text{ A}$		0.0016	0.0020	Ω

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	$V_{DD}=15\text{ V}, I_D = 35\text{ A}$ $V_{GS}=4.5\text{ V}$ (see Figure 14)	-	61.5	-	nC
Q_{gs}	Gate-source charge		-	20		nC
Q_{gd}	Gate-drain charge		-	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	-	Ω

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD}=15\text{ V}, I_D = 17.5\text{ A},$ $R_G=4.7\text{ }\Omega, V_{GS}=10\text{ V}$ (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	$V_{GS}=0$, $I_{SD} = 35$ A	-		1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 35$ A, $di/dt = 100$ A/ μ s, $V_{DD}=25$ 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 μ s, duty cycle 1.5%.

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

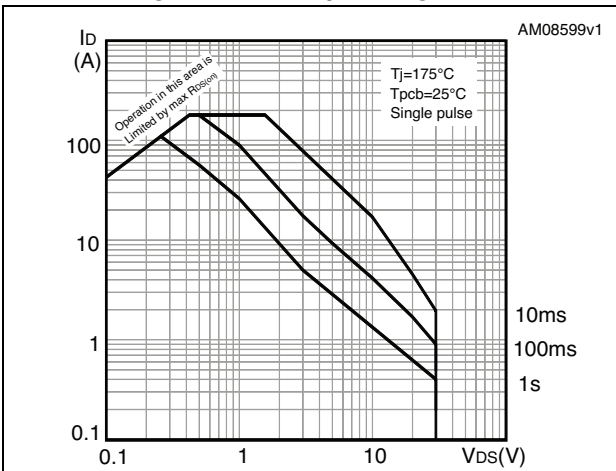


Figure 3. Thermal impedance

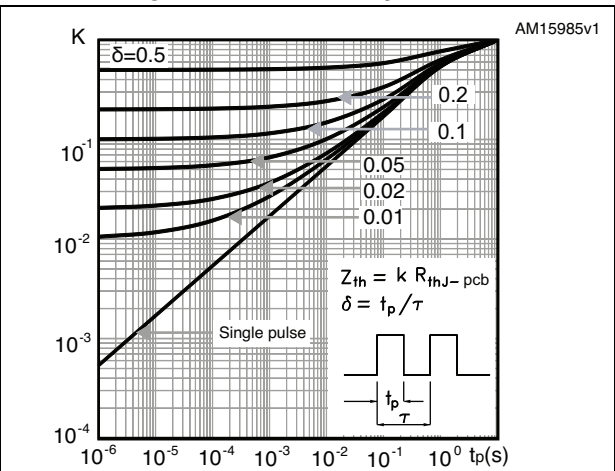


Figure 4. Output characteristics

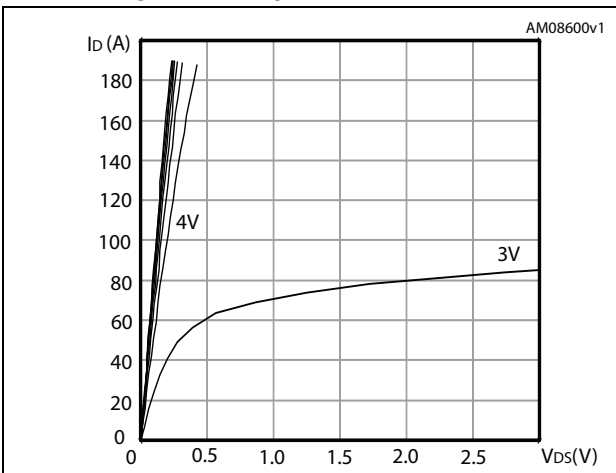


Figure 5. Transfer characteristics

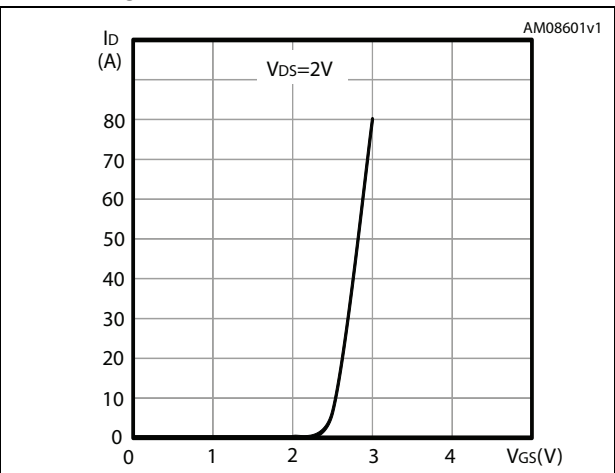


Figure 6. Normalized $V_{(BR)DSS}$ vs temperature

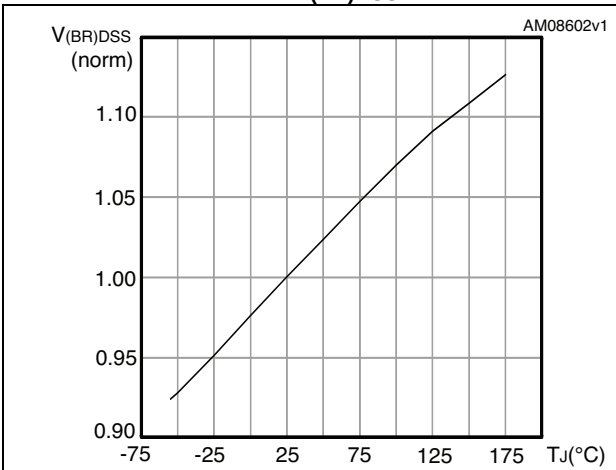


Figure 7. Static drain-source on-resistance

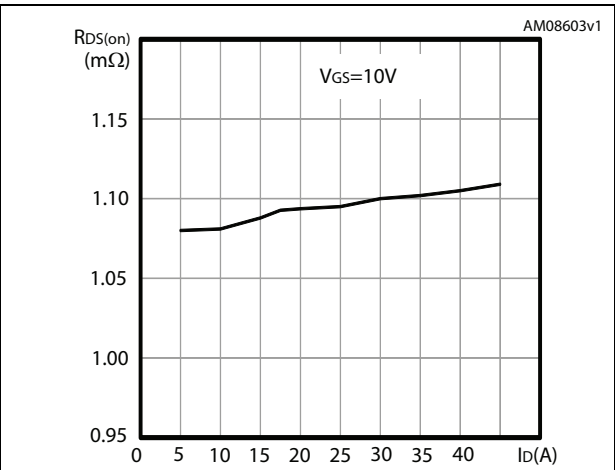


Figure 8. Gate charge vs gate-source voltage

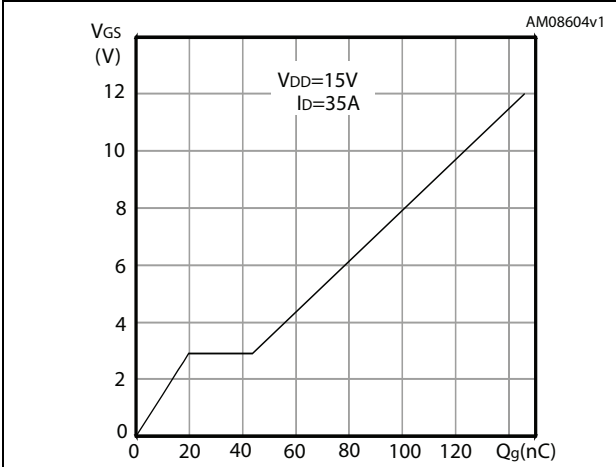


Figure 9. Capacitance variations

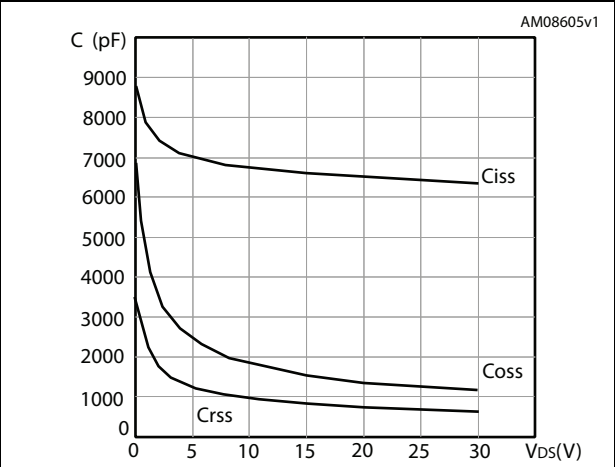


Figure 10. Normalized gate threshold voltage vs temperature

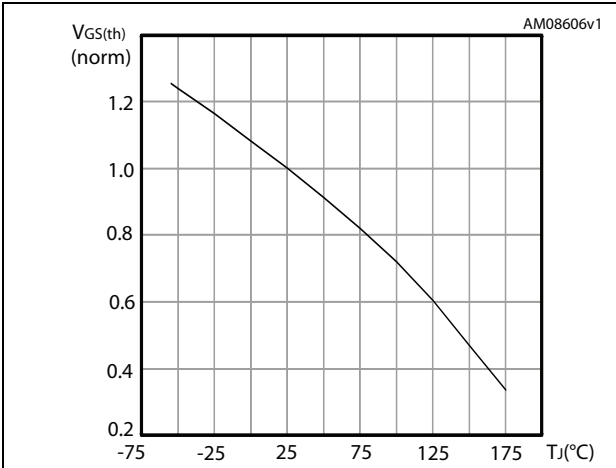


Figure 11. Normalized on-resistance vs temperature

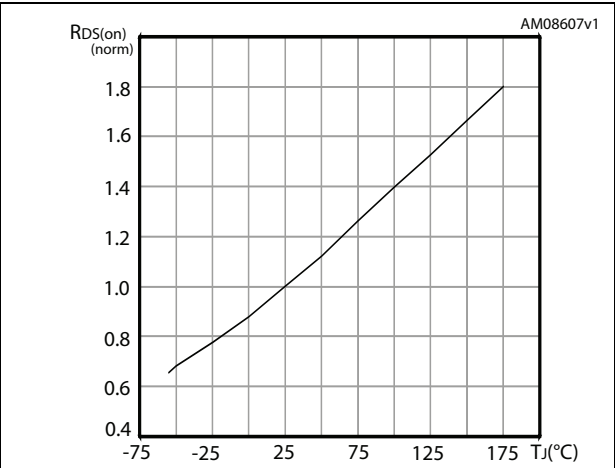
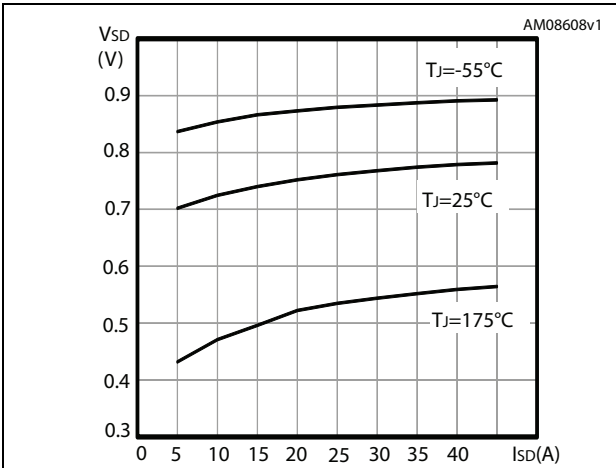


Figure 12. Source-drain diode forward characteristics



4 Package mechanical data

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

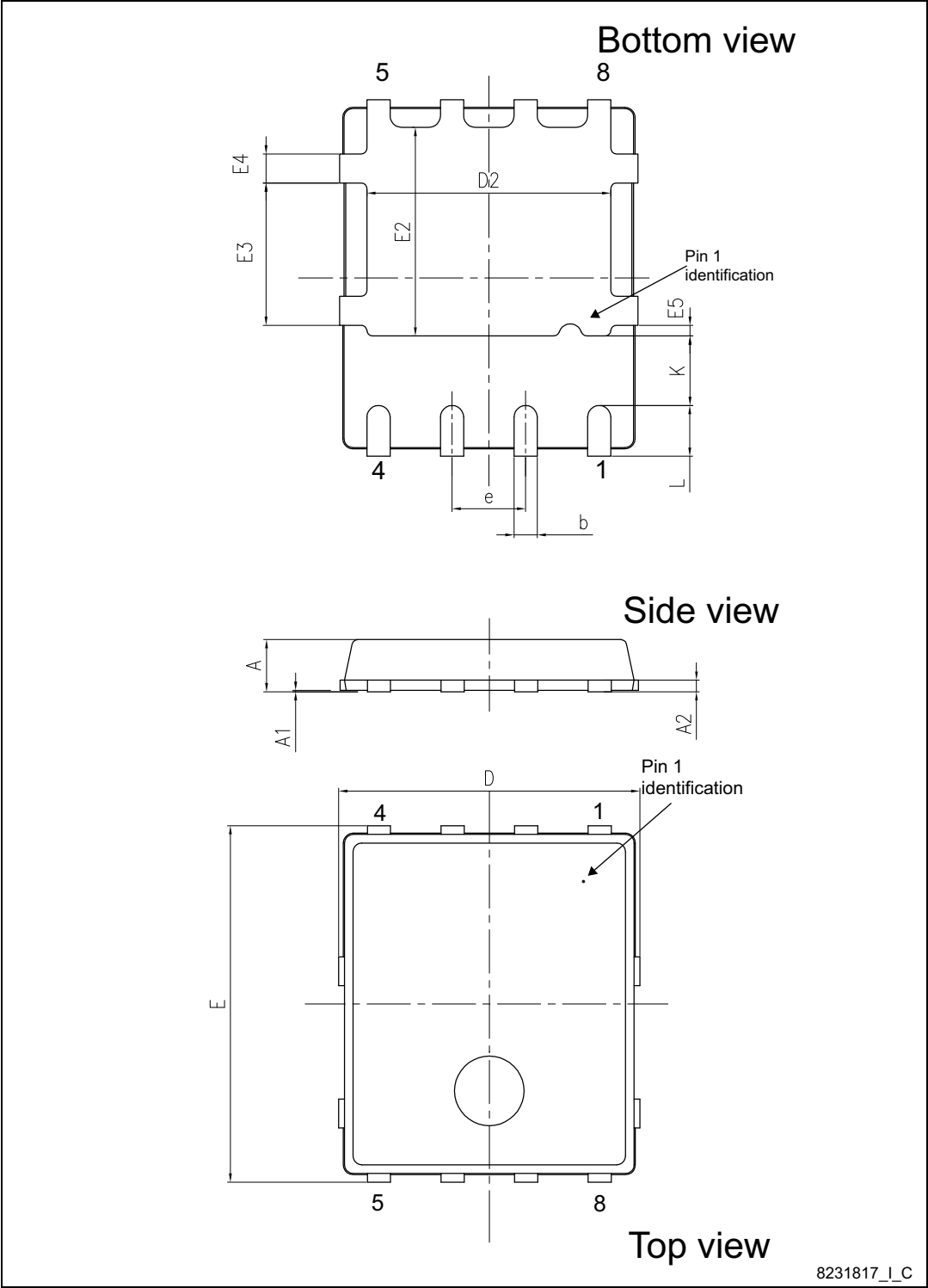
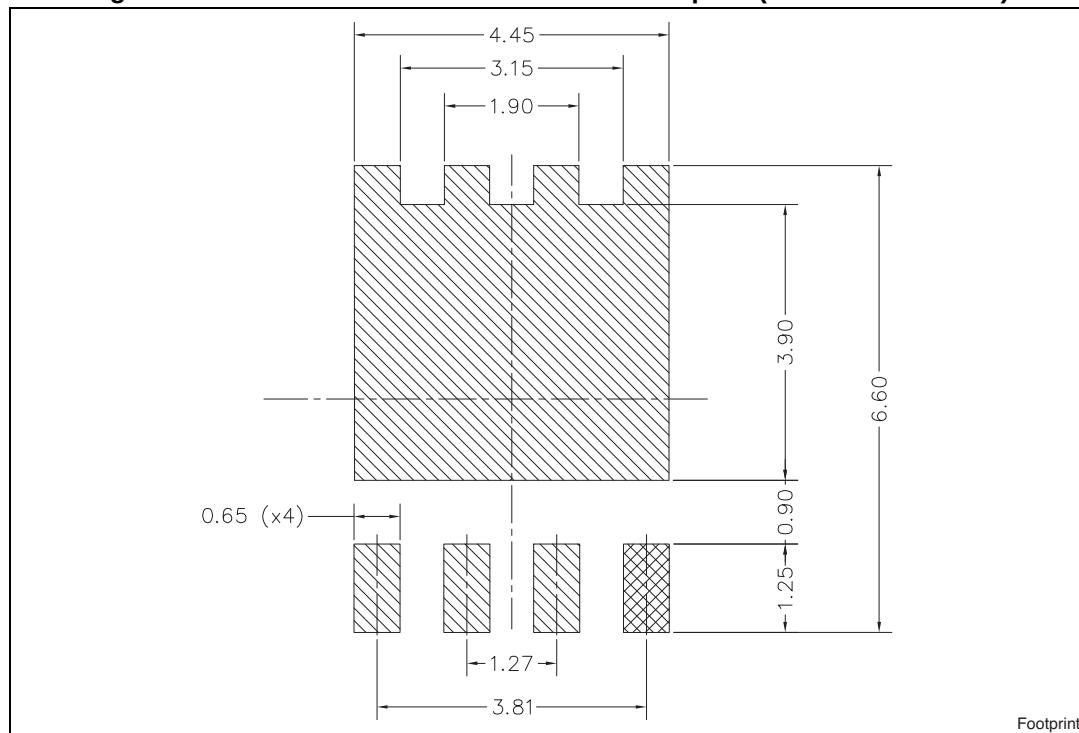


Table 9. PowerFLAT™ 5x6 type S-C mechanical data

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)

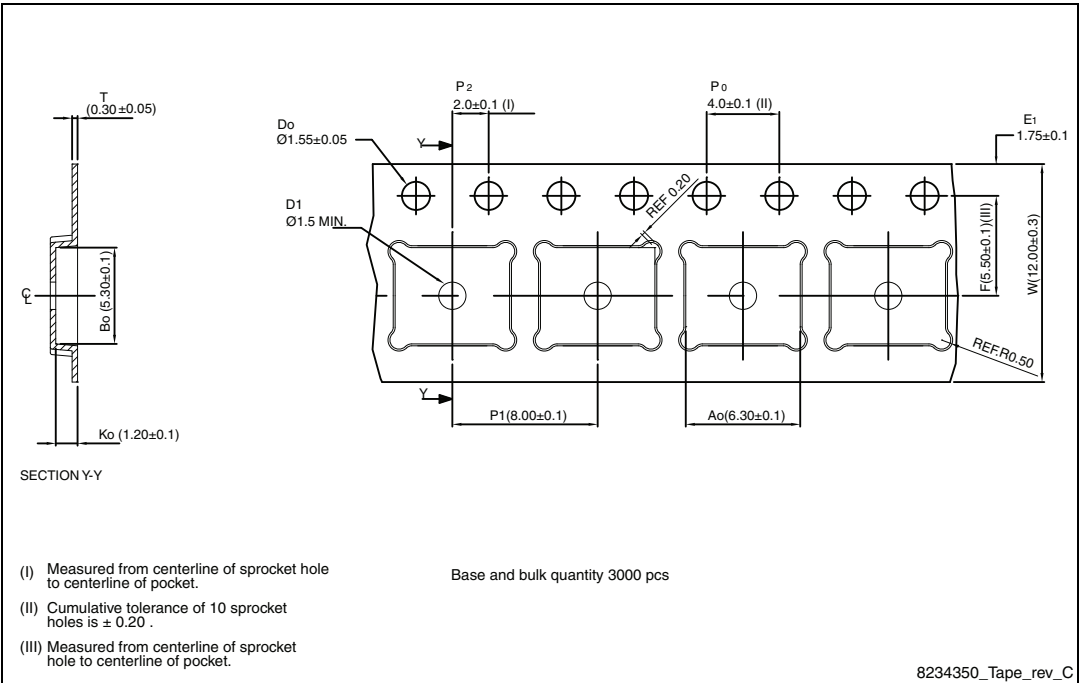
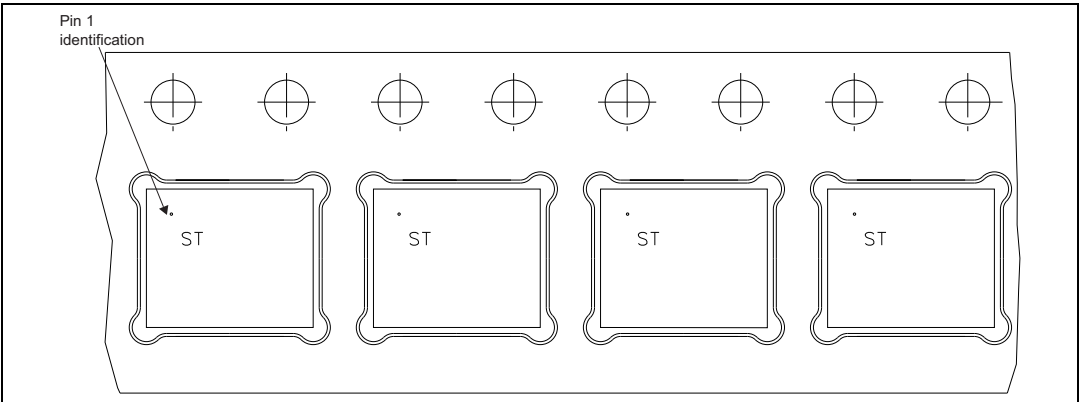
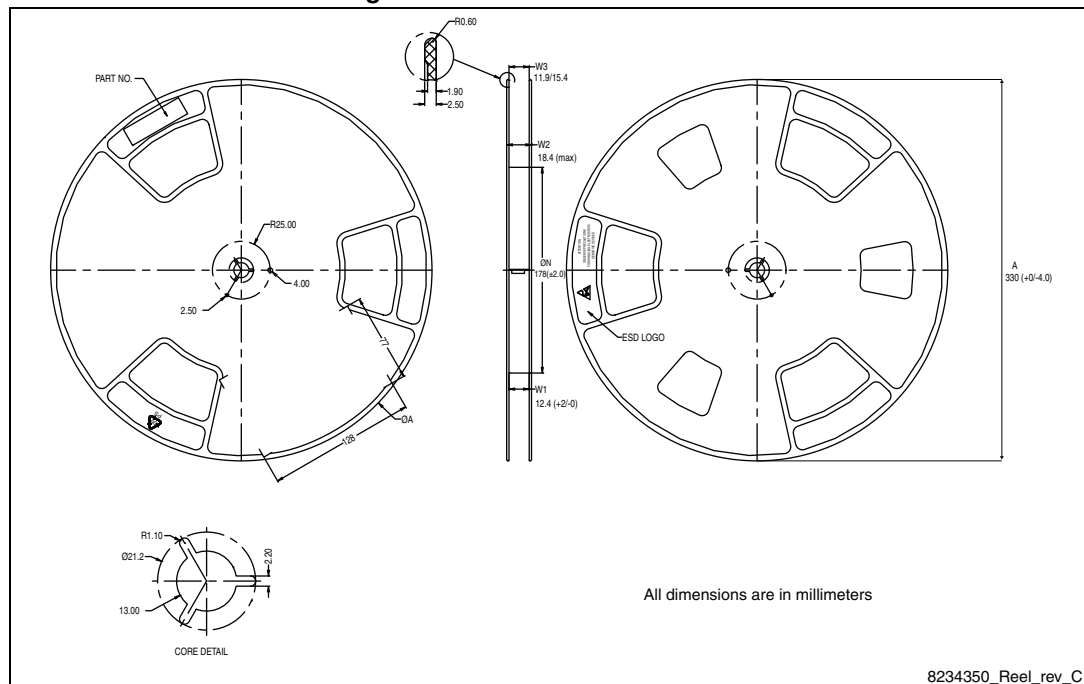


Figure 22. PowerFLAT™ 5x6 package orientation in carrier tape



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	Section 4: Package mechanical data has been updated. Minor text changes.
31-Jul-2013	3	– Modified: I_D in the title and in the Features Table, Table 5, 6 and 7 – Modified: values on the Table 2, $R_{thj-case}$ on the Table 3, max values for the I_{SD} and I_{SDM} on Table 8 – Updated: Section 4: Package mechanical data – Inserted: Section 5: Packaging mechanical data – Modified: Figure 13, 14, 15 and 16 – Minor text changes
09-Aug-2013	4	– Modified: drain current (continuous) at $T_C = 100\text{ °C}$ value and drain current (continuous) at $T_{pcb}=100\text{ °C}$ value – Modified: test conditions of $R_{DS(on)}$ – Modified: I_D in Table 6 and 7 – Modified: I_{SD} in Table 8 – Modified: Figure 2, 3, 4, 5, 7, 12, 13, 14, 15 and 16 – Updated: Section 4: Package mechanical data – Minor text changes
24-Sep-2013	5	– Modified: marking in Table 1 – Minor text changes
23-Sep-2014	6	– Modified: title – Modified: Features – Modified: Description – Updated: Section 4: Package mechanical data – Minor text changes

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