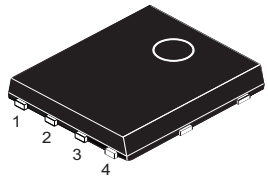
STL160NS3LLH7

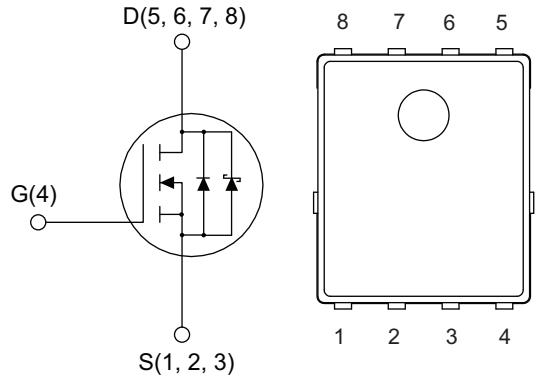
N-channel 30 V, 0.0016 Ω typ., 160 A STripFET™ H7 Power MOSFET plus monolithic Schottky in a PowerFLAT™ 5x6

Datasheet - production data



PowerFLAT™5x6

Figure 1. Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max	I_D
STL160NS3LLH7	30 V	0.0021 Ω	160 A

- Very low on-resistance
- Very low Q_g
- 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.

Table 1. Device summary

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

Contents

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

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

Table 3. Thermal data

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

1. When mounted on FR-4 board of 1 inch², 2oz Cu, t < 10 sec

2 Electrical characteristics

(T_C = 25 °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 mA	30			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0, V_{DS} = 24 V			500	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0, V_{GS} = ± 20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 1 mA	1.2		2.3	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 18 A		0.0016	0.0021	Ω
		V_{GS} = 4.5 V, I_D = 18 A		0.0025	0.0031	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	-	3245	-	pF
C_{oss}	Output capacitance		-	970	-	pF
C_{rss}	Reverse transfer capacitance		-	52	-	pF
Q_g	Total gate charge	V_{DD} = 15 V, I_D = 36 A, V_{GS} = 4.5 V (see *Figure 13*)	-	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 V, I_D = 18 A, R_G = 4.7 Ω, V_{GS} = 4.5 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 A	-	0.4	0.7	V
t_{rr}	Reverse recovery time	V_{GS} = 0 V, I_D = 36 A, di/dt = 100 A/µs	-	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 µs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

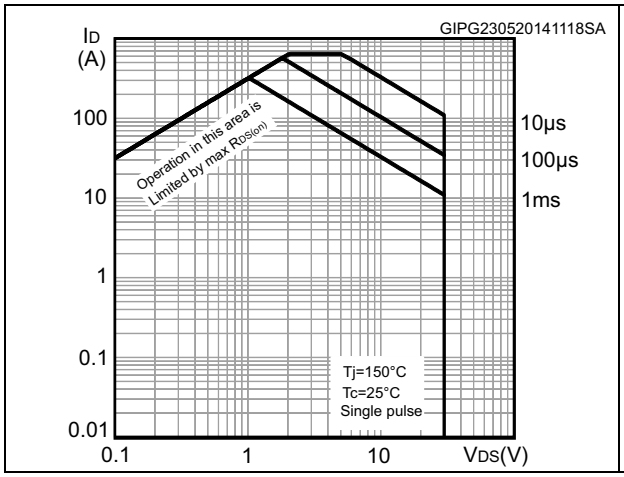


Figure 3. Thermal impedance

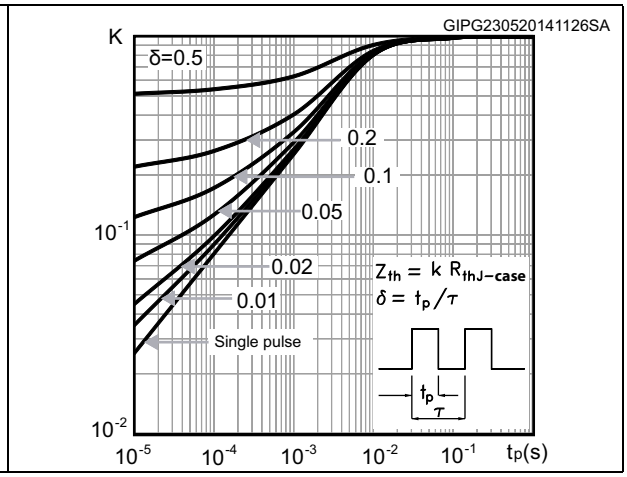


Figure 4. Output characteristics

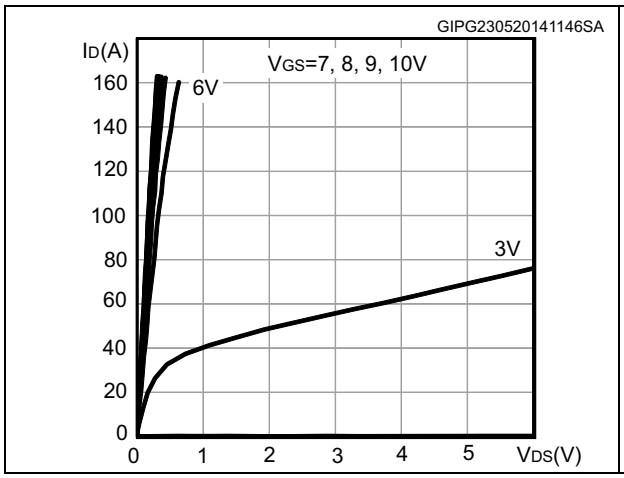


Figure 5. Transfer characteristics

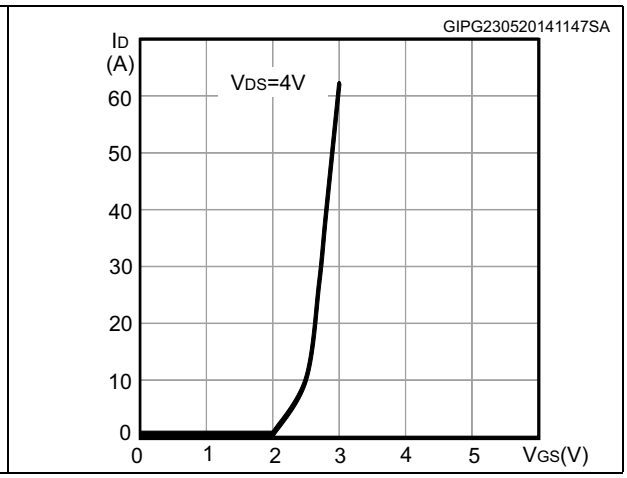


Figure 6. Gate charge vs gate-source voltage

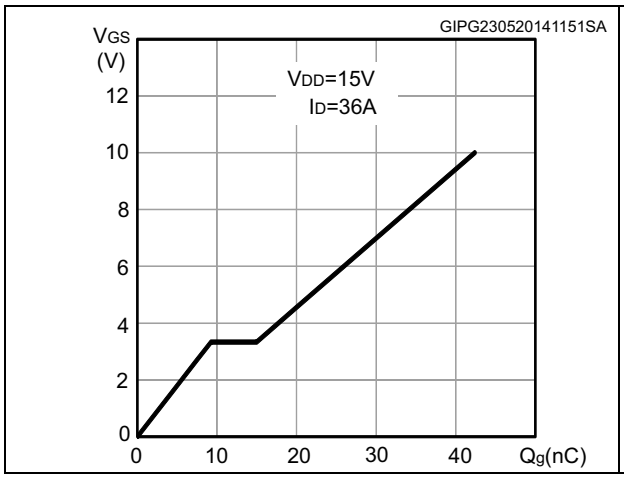


Figure 7. Static drain-source on-resistance

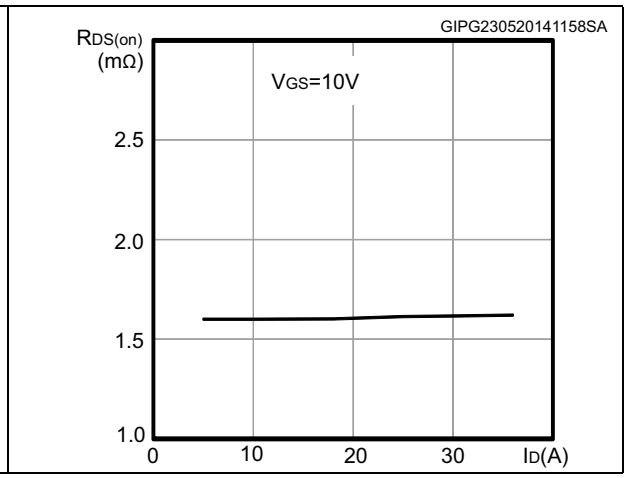


Figure 8. Capacitance variations

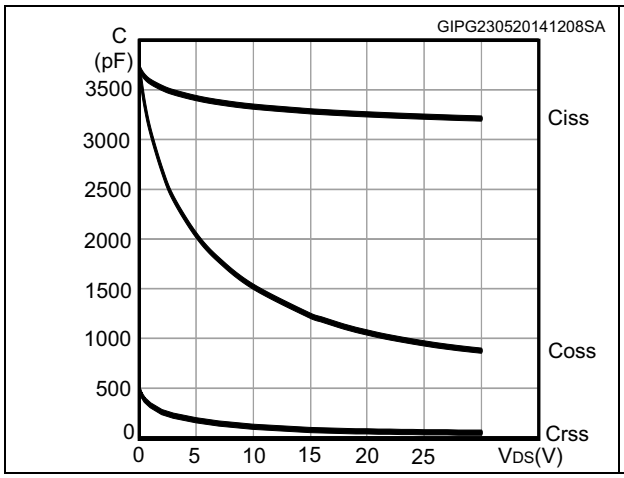


Figure 9. Normalized gate threshold voltage vs temperature

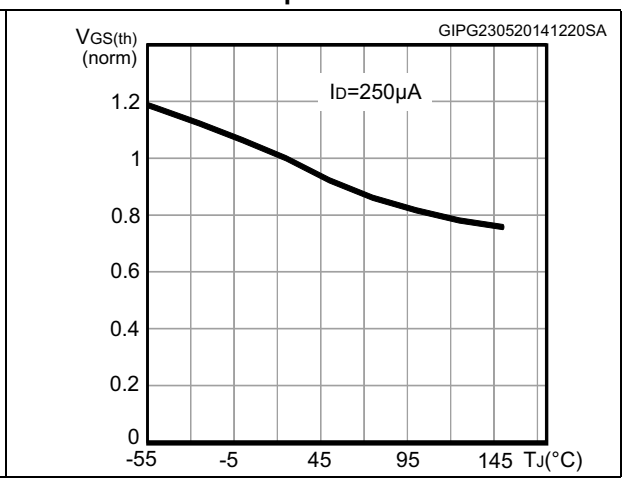


Figure 10. Normalized on-resistance vs temperature

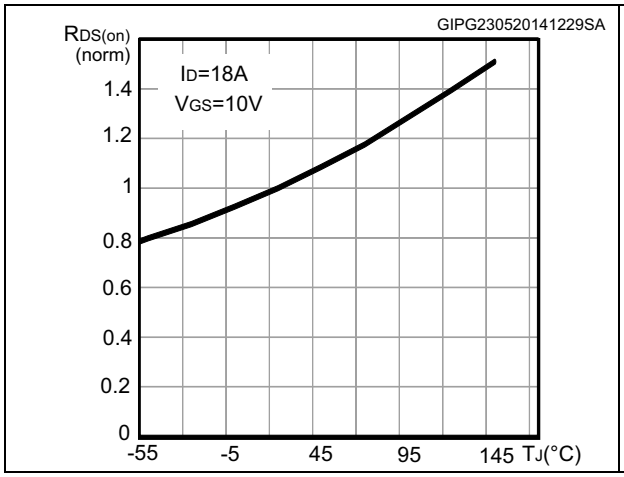
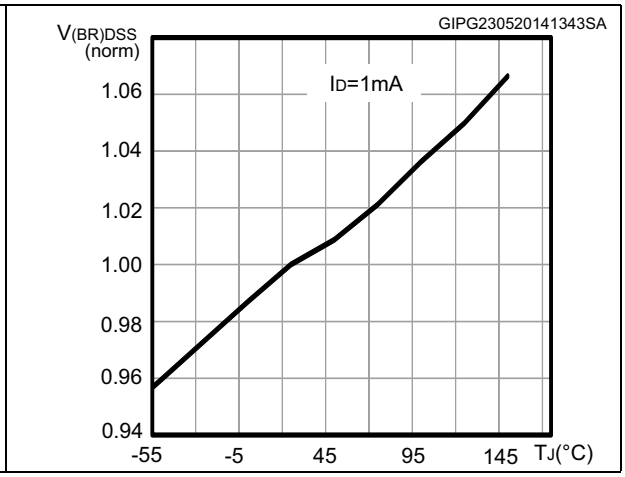


Figure 11. Normalized $V_{(BR)DSS}$ vs temperature



3 Test circuits

Figure 12. Switching times test circuit for resistive load

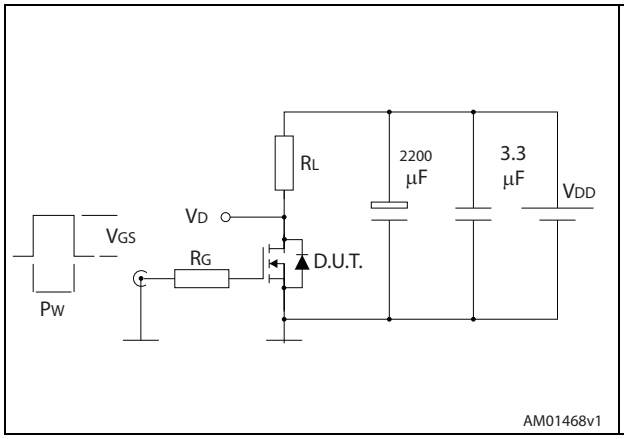


Figure 13. Gate charge test circuit

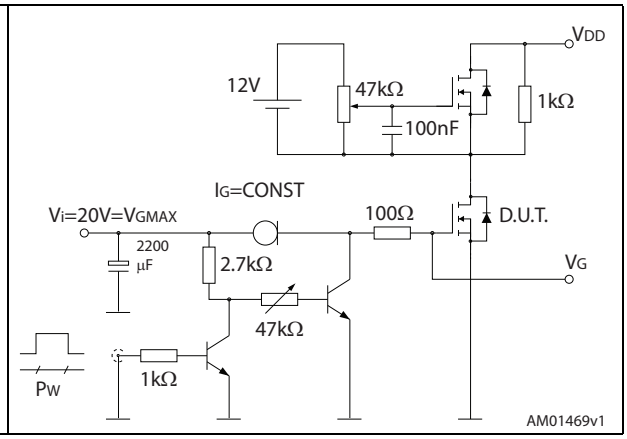


Figure 14. Test circuit for inductive load switching and diode recovery times

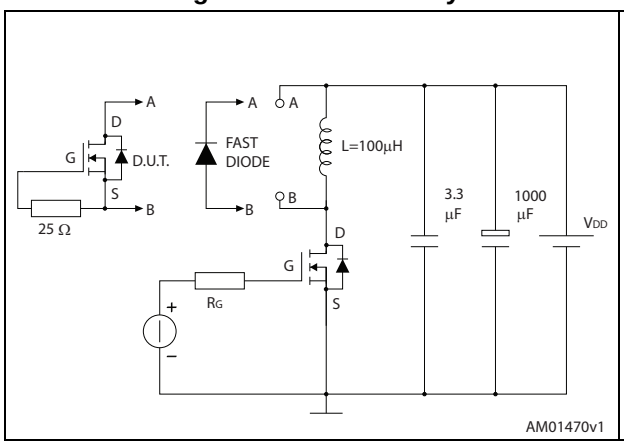


Figure 15. Unclamped inductive load test circuit

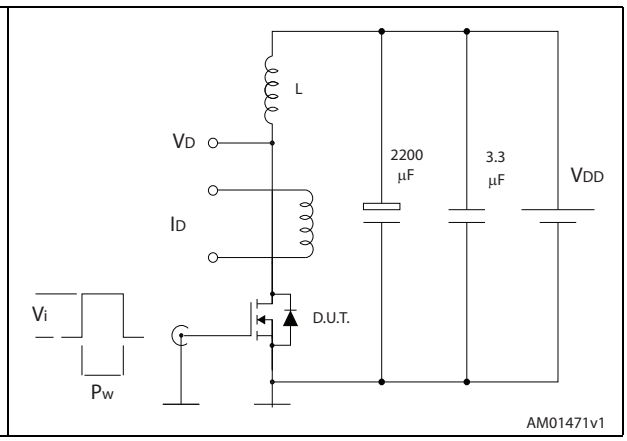


Figure 16. Unclamped inductive waveform

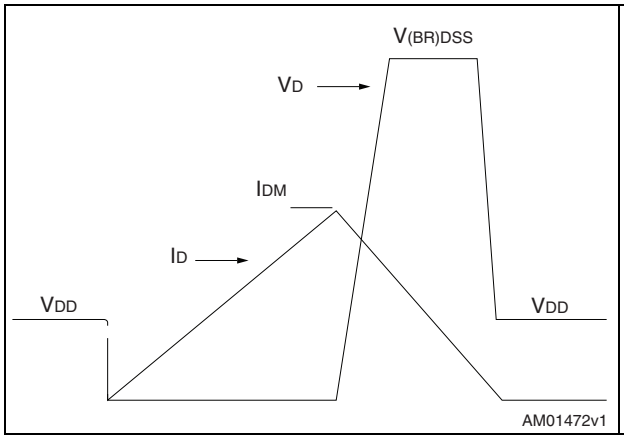
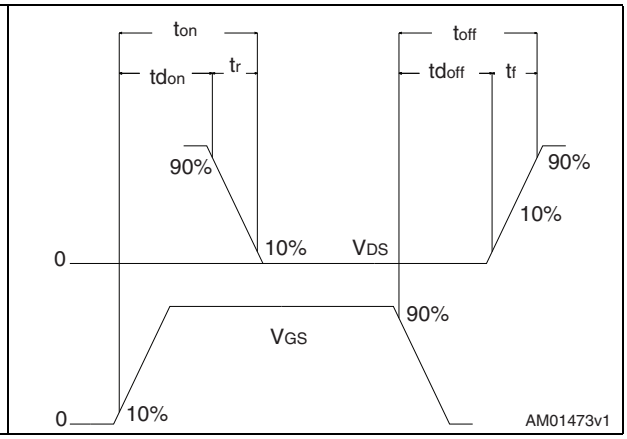


Figure 17. Switching time waveform



4 Package 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 18. PowerFLAT™ 5x6 type S-C mechanical data

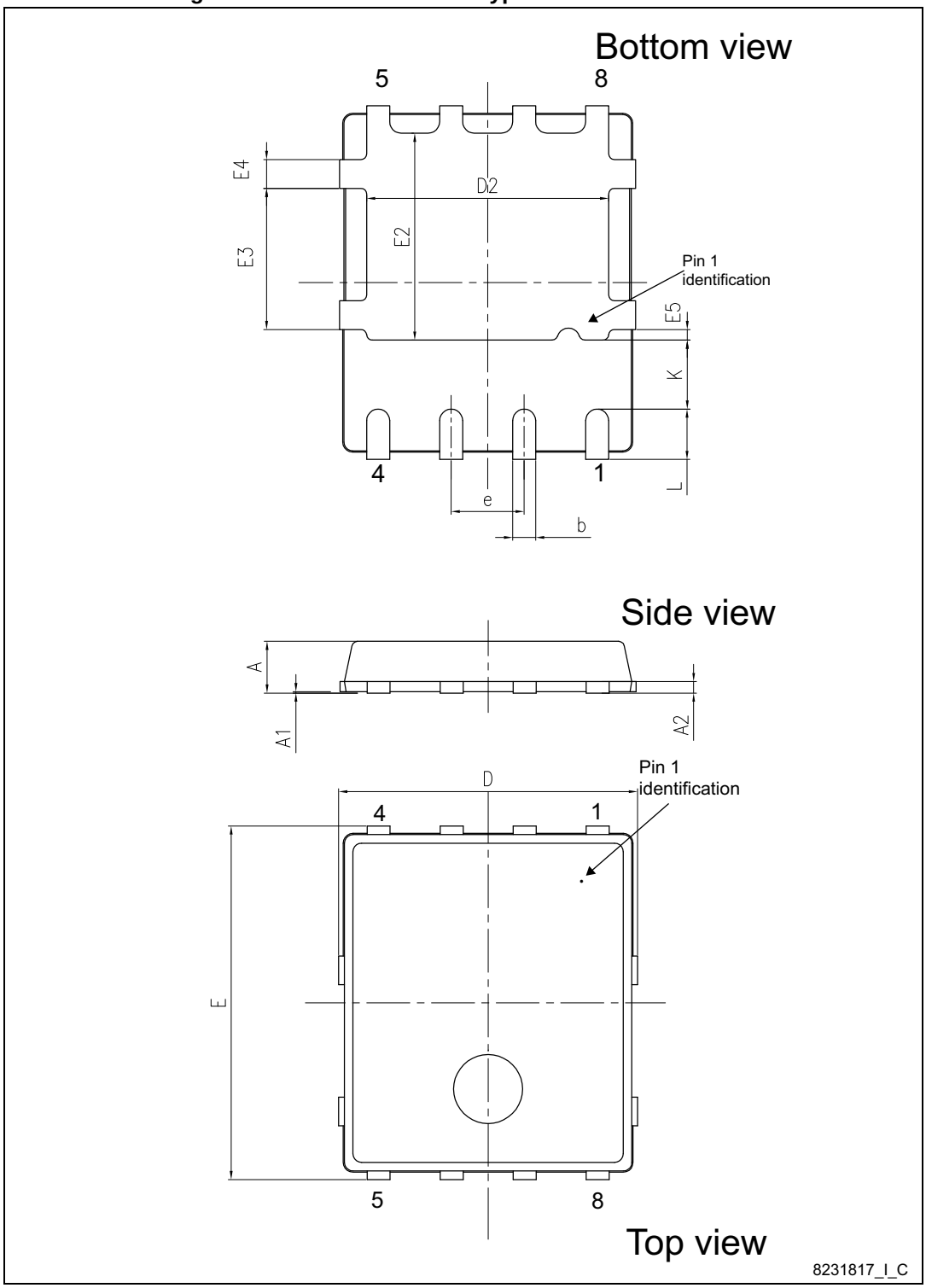
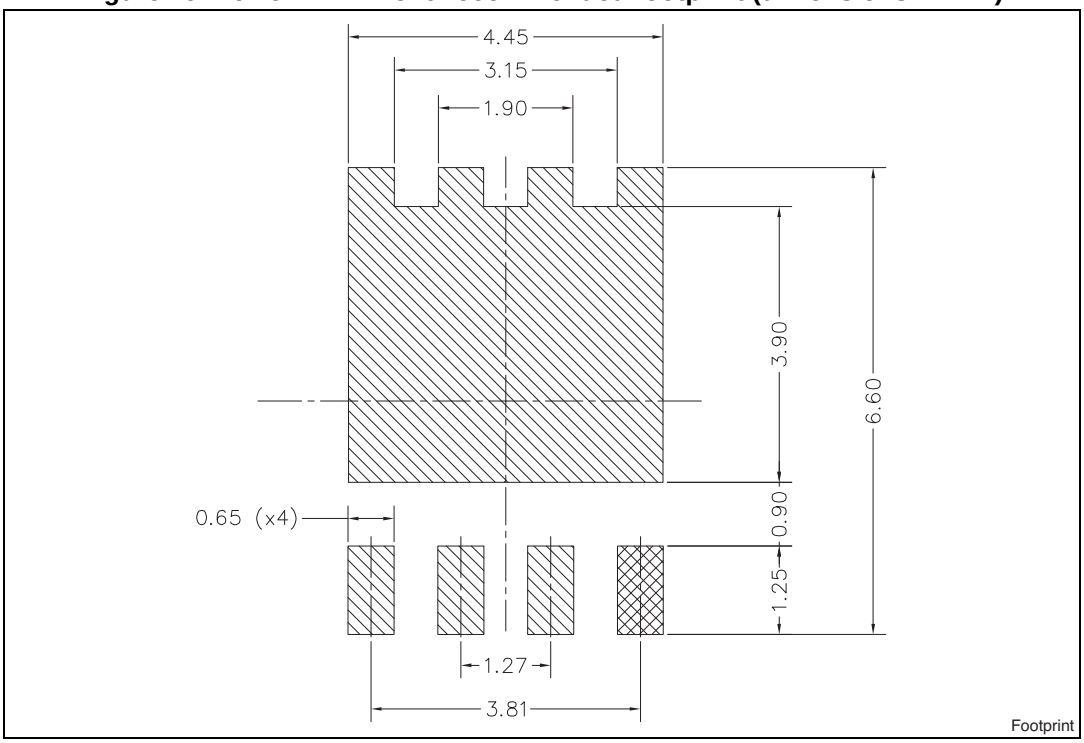


Table 8. PowerFLAT™ 5x6 type S-C mechanical data

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[(a)]

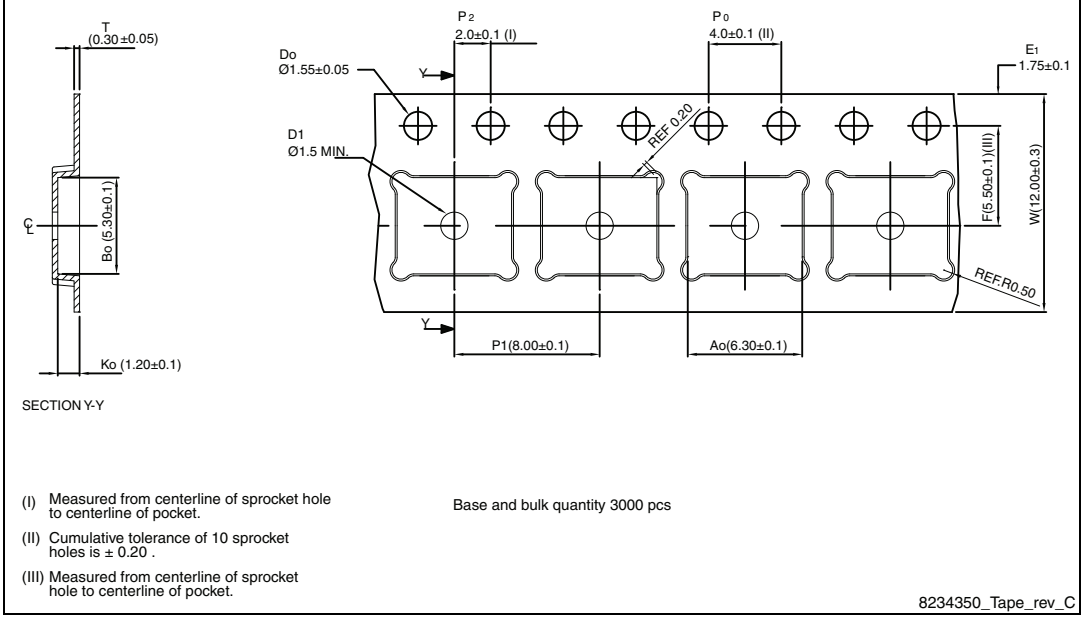
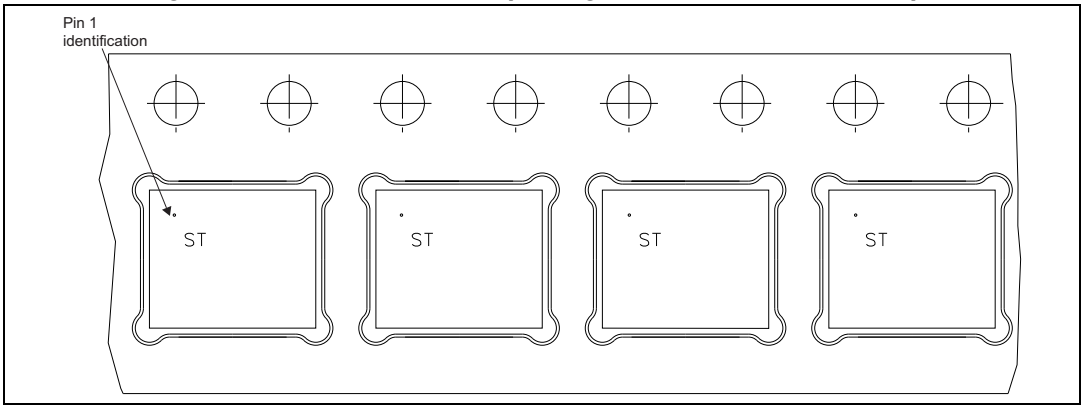
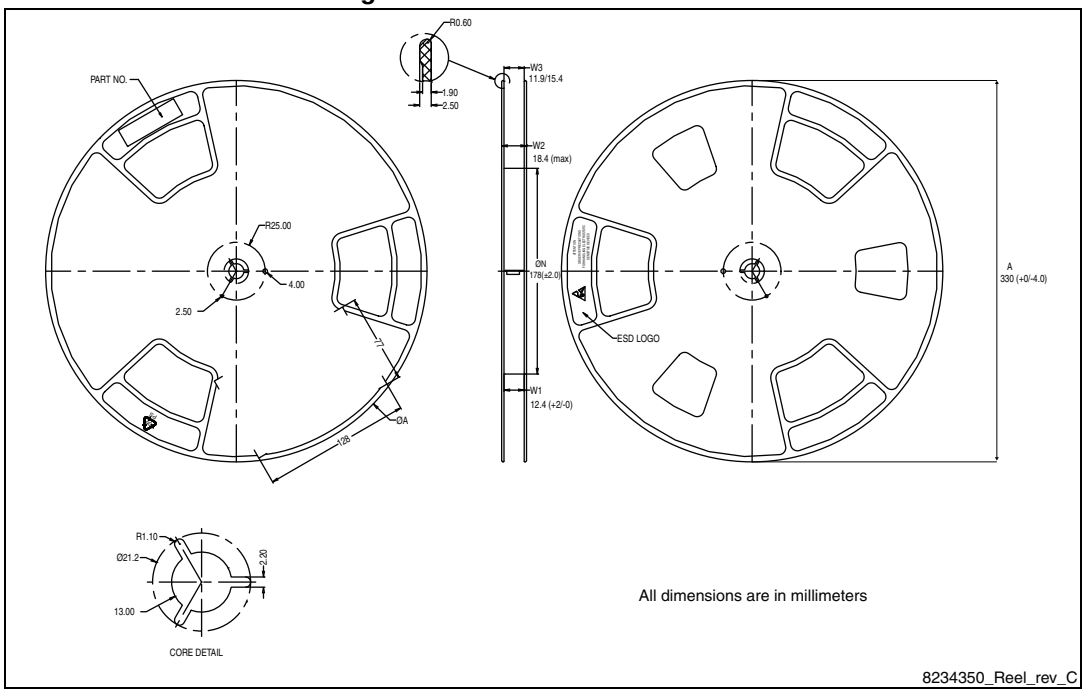


Figure 21. PowerFLAT™ 5x6 package orientation in carrier tape



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	– Document status promoted from target to production data – Modified: T_J value in *Table 2* – Modified: the entire typical values in *Table 5*, *6*, *7* – Added: *Section 2.1: Electrical characteristics (curves)* – Updated: *Section 4: Package mechanical data* – Minor text changes
18-Jun-2014	3	– Added: E_{AS} value in *Table 2* – Updated: *Section 4: Package mechanical data* – Minor text changes
24-Jul-2014	4	– Modified: title and features – Modified: P_{TOT} values in *Table 2* – Modified: I_{SD} and I_{SDM} max values in *Table 7* – Minor text changes