



STL56N3LLH5

N-channel 30 V, 0.0076 Ω typ., 15 A STripFET™V Power MOSFET
in a PowerFLAT™ 5x6 package

Datasheet — production data

Features

Order code	V _{DSS}	R _{DS(on)} max	I _D
STL56N3LLH5	30 V	< 0.009 Ω	15 A ⁽¹⁾

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

- R_{DS(on)} * Q_g industry benchmark
- Extremely low on-resistance R_{DS(on)}
- Very low switching gate charge
- High avalanche ruggedness
- Low gate drive power losses

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using STMicroelectronics' STripFET™V 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.



Figure 1. Internal schematic diagram

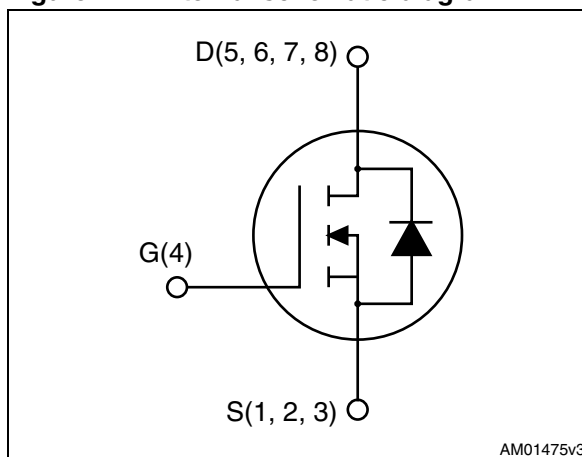


Table 1. Device summary

Order code	Marking	Package	Packaging
STL56N3LLH5	56N3LLH5	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	+22 / -20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ °C}$	56	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ °C}$	37	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25\text{ °C}$	15	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 100\text{ °C}$	10	A
$I_{DM}^{(2)(3)}$	Drain current (pulsed)	60	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ °C}$	62.5	W
$P_{TOT}^{(2)}$	Total dissipation at $T_{pcb} = 25\text{ °C}$	4	W
	Derating factor	0.03	W/°C
$E_{AS}^{(4)}$	Single pulse avalanche energy	150	mJ
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 150	°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
4. Starting $T_j = 25\text{ °C}$, $I_D = 60\text{ A}$, $V_{DD} = 50\text{ V}$

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	2	°C/W
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	31.3	°C/W

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

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 250\text{ }\mu\text{A}$	30			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 30\text{ V},$			1	μA
		$V_{GS} = 0$ $V_{DS} = 30\text{ V}, T_C = 125\text{ °C}$			10	μA
I_{GSS}	Gate body leakage current	$V_{DS} = 0, V_{GS} = +22 / -20\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1		2.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 7.5\text{ A}$		0.0076	0.009	Ω
		$V_{GS} = 4.5\text{ V}, I_D = 7.5\text{ A}$		0.0099	0.0112	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}, f = 1\text{ MHz}, V_{GS} = 0$	-	950		pF
C_{oss}	Output capacitance			193		pF
C_{rss}	Reverse transfer capacitance			27		pF
Q_g	Total gate charge			6.5	10	nC
Q_{gs}	Gate-source charge	$V_{DD} = 15\text{ V}, I_D = 15\text{ A}$ $V_{GS} = 4.5\text{ V}$ <i>Figure 14</i>	-	3.3		nC
Q_{gd}	Gate-drain charge			2.4		nC
R_g	Gate input resistance	$f = 1\text{ MHz}$ gate DC bias = 0 test signal level = 20 mV open drain	-	1.7	2.5	Ω

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 15\text{ V}, I_D = 7.5\text{ A},$ $R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ <i>Figure 13</i>	-	10.8		ns
t_r	Rise time			15.6		ns
$t_{d(off)}$	Turn-off delay time			14.2		ns
t_f	Fall time			6		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current		-		15	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		60	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 15\text{ A}$, $V_{GS}=0$	-		1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 15\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD}=25\text{ V}$, $T_j=150\text{ }^\circ\text{C}$	-	20	36	ns
Q_{rr}	Reverse recovery charge			10	18	nC
I_{RRM}	Reverse recovery current			1		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

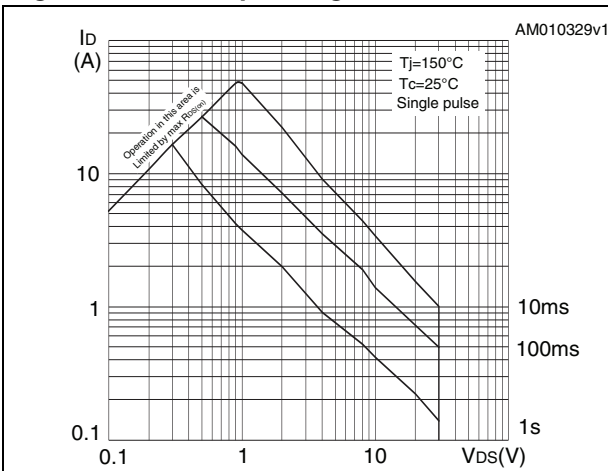


Figure 3. Thermal impedance

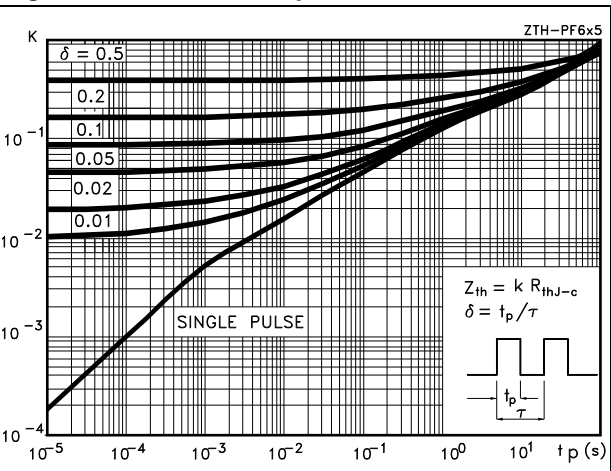


Figure 4. Output characteristics

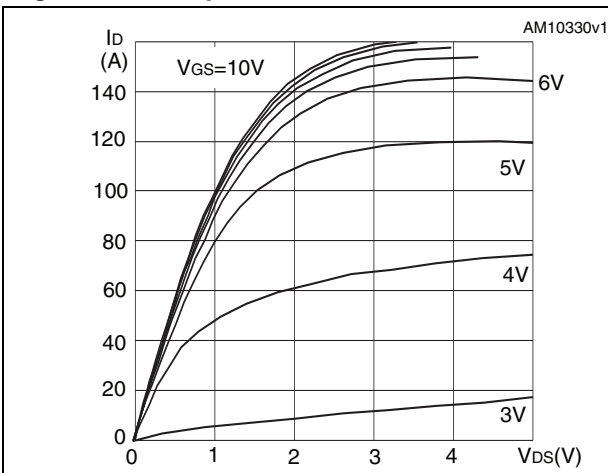


Figure 5. Transfer characteristics

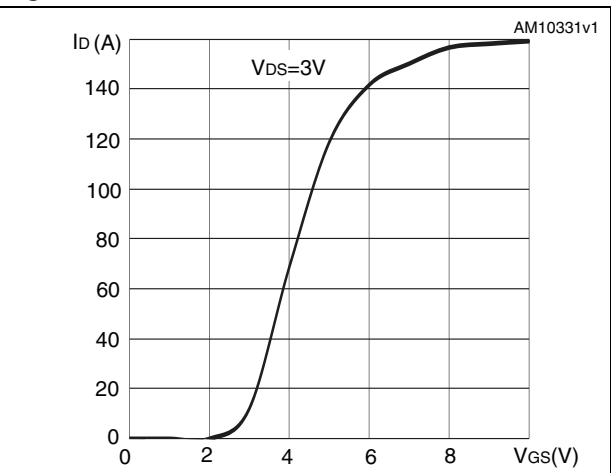


Figure 6. Normalized $B_{V_{DSS}}$ vs temperature

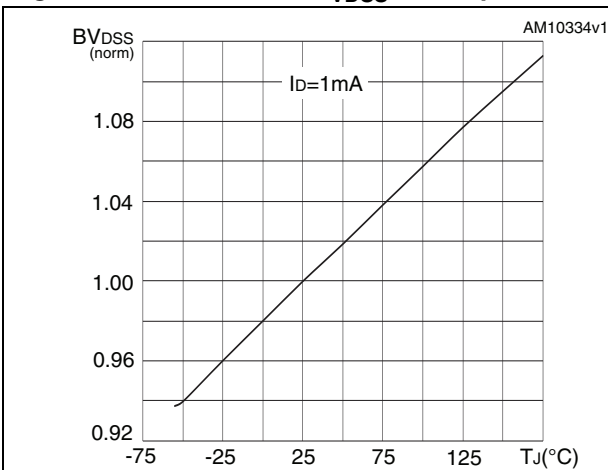


Figure 7. Static drain-source on-resistance

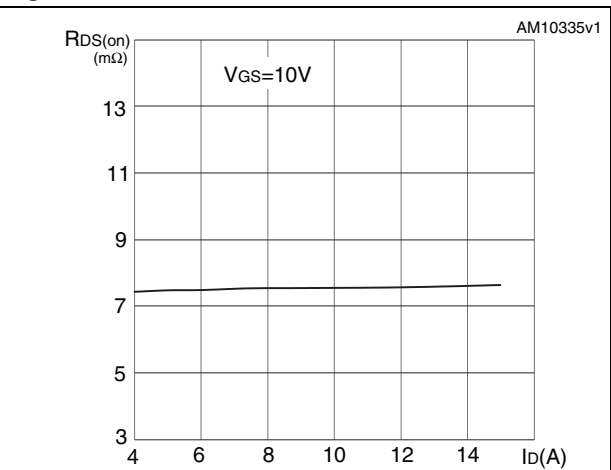


Figure 8. Gate charge vs gate-source voltage

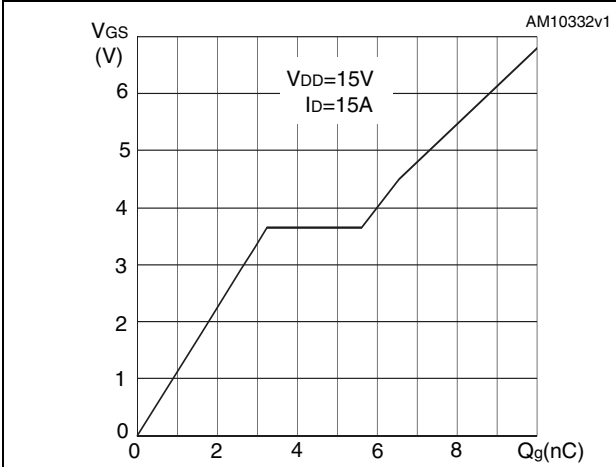


Figure 9. Capacitance variations

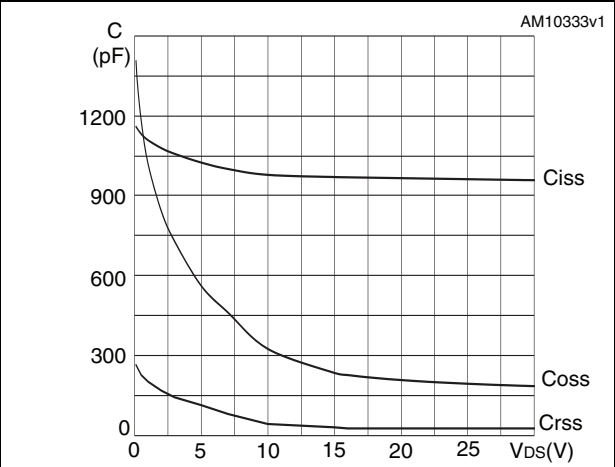


Figure 10. Normalized gate threshold voltage vs temperature

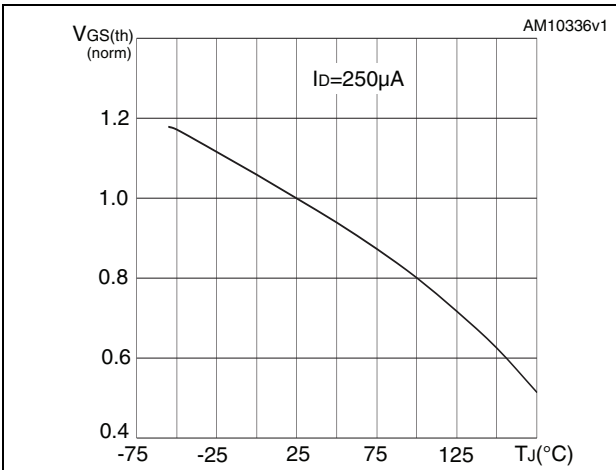


Figure 11. Normalized on-resistance vs temperature

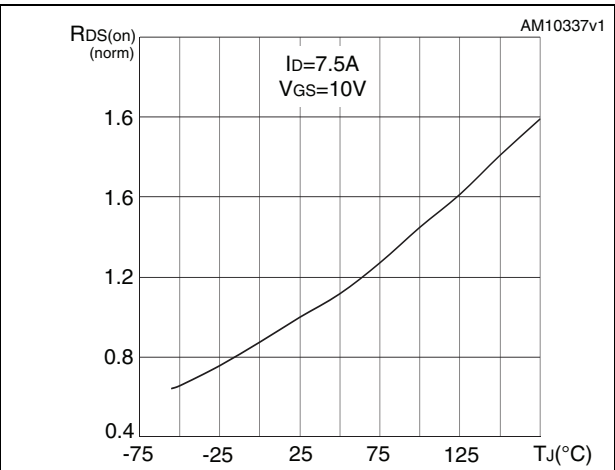
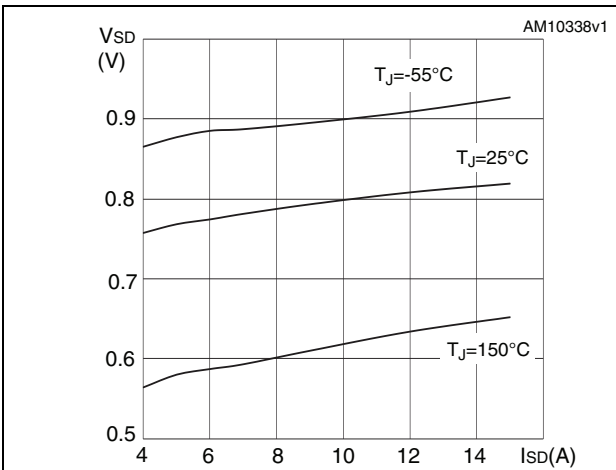


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

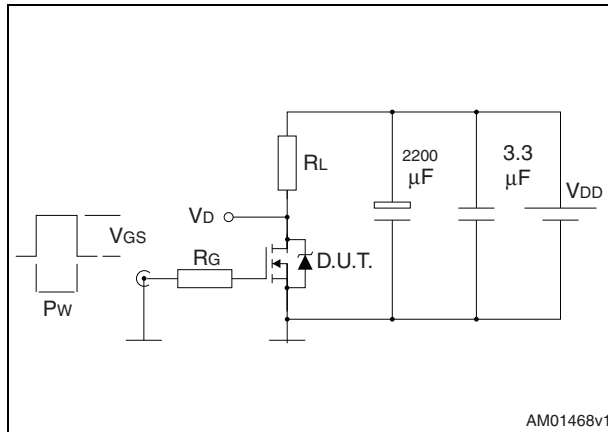


Figure 14. Gate charge test circuit

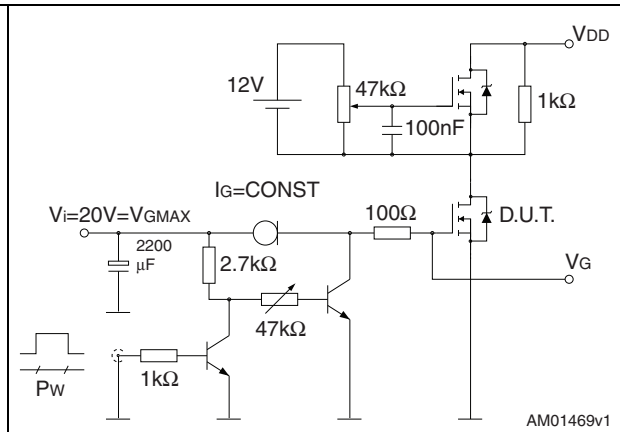


Figure 15. Test circuit for inductive load switching and diode recovery times

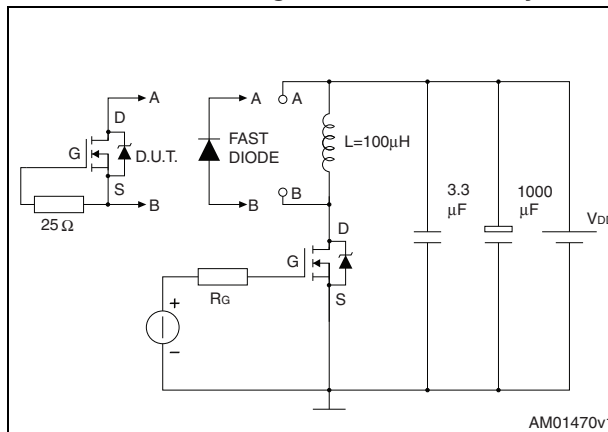


Figure 16. Unclamped inductive load test circuit

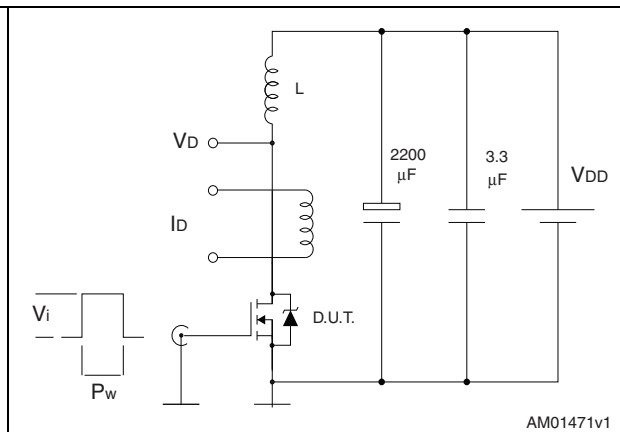


Figure 17. Unclamped inductive waveform

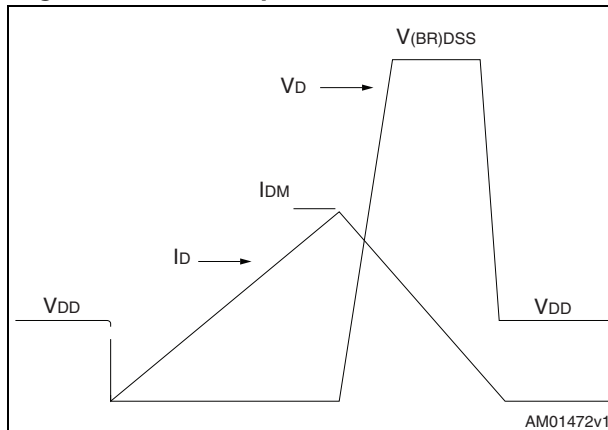
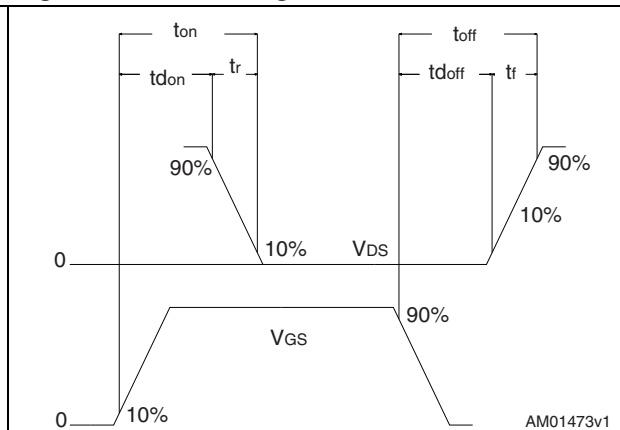


Figure 18. Switching time waveform



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.

Table 8. PowerFLAT 5x6 type S-R 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	5.00	5.20	5.40
E	5.95	6.15	6.35
D2	4.11		4.31
E2	3.50		3.70
e		1.27	
L	0.60		0.80
K	1.275		1.575

Figure 19. PowerFLAT™ 5x6 type S-R drawing

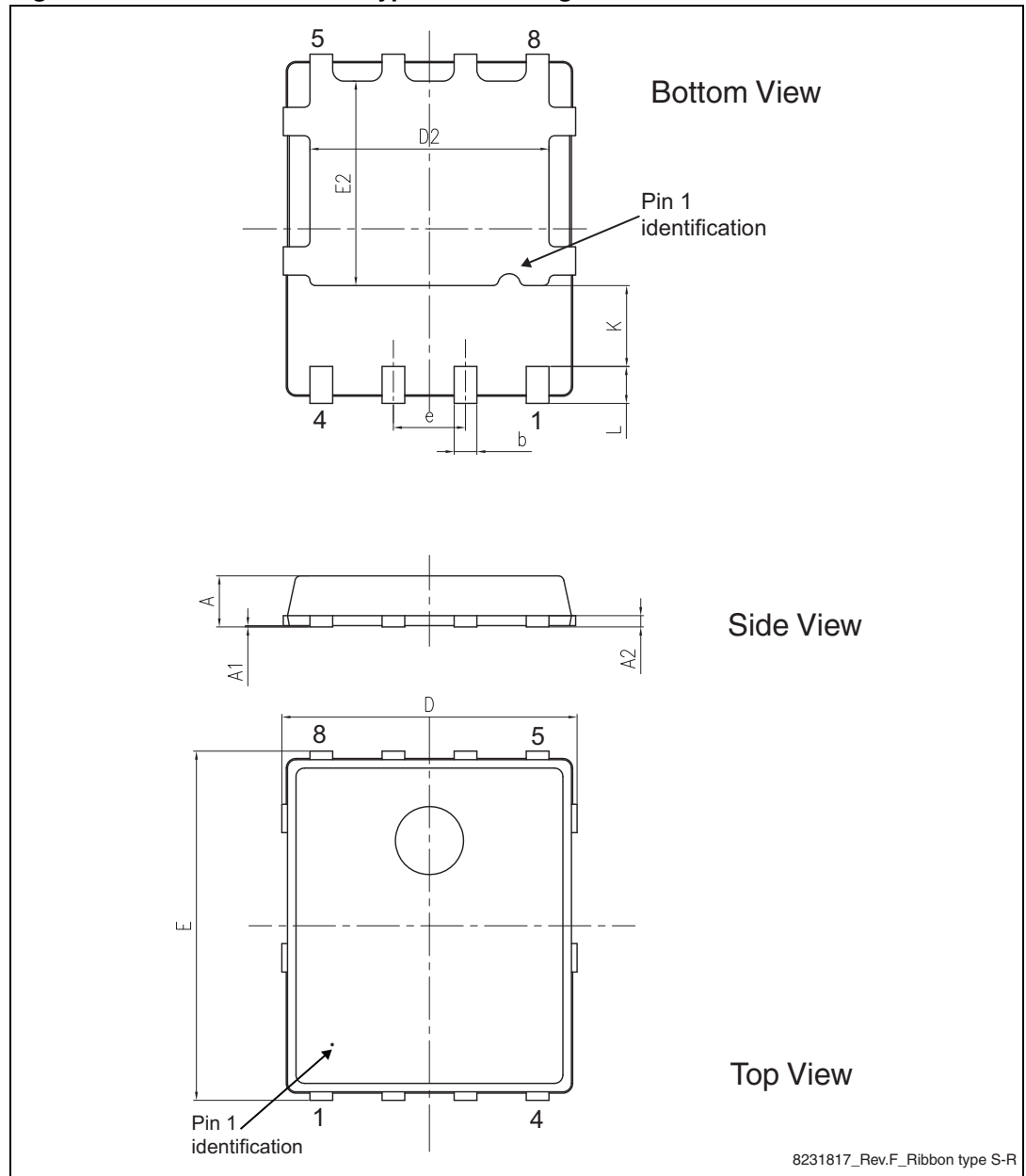
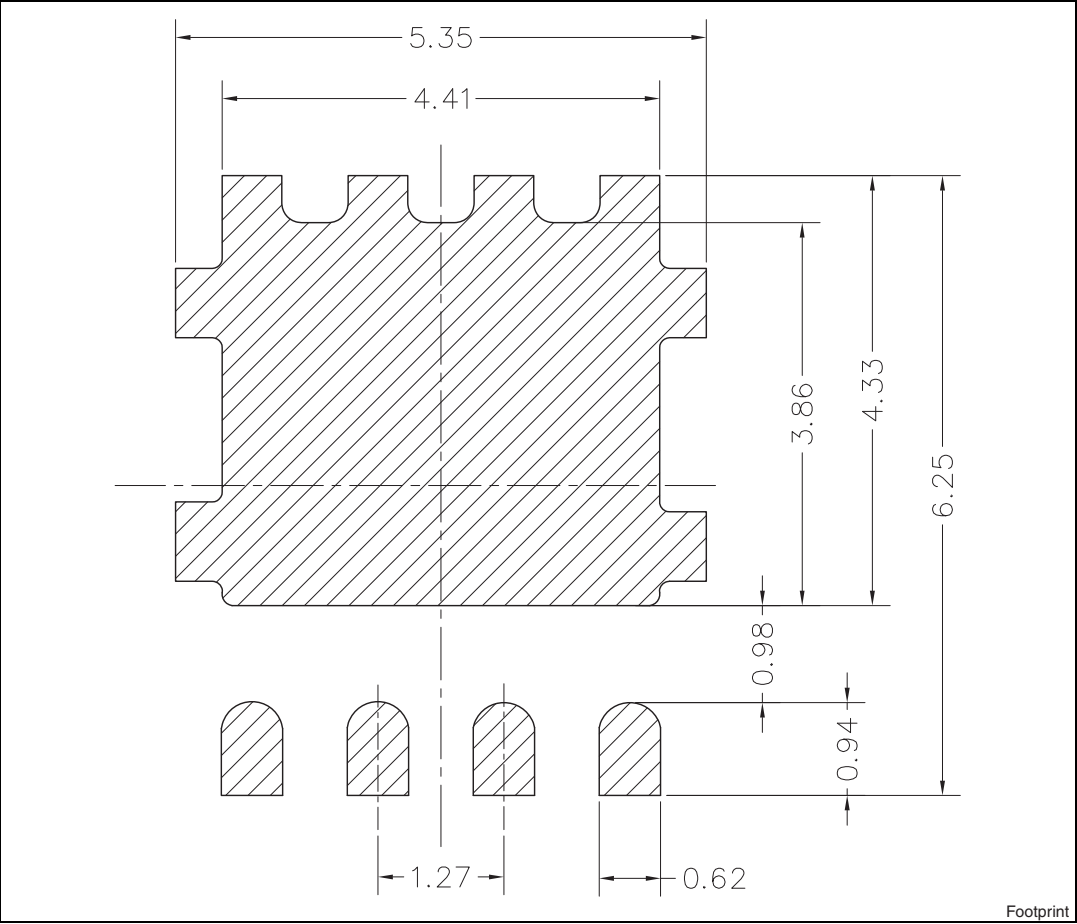


Figure 20. PowerFLAT™ 5x6 recommended footprint (dimensions are in mm)



5 Packaging mechanical data

Figure 21. PowerFLAT™ 5x6 tape^(a)

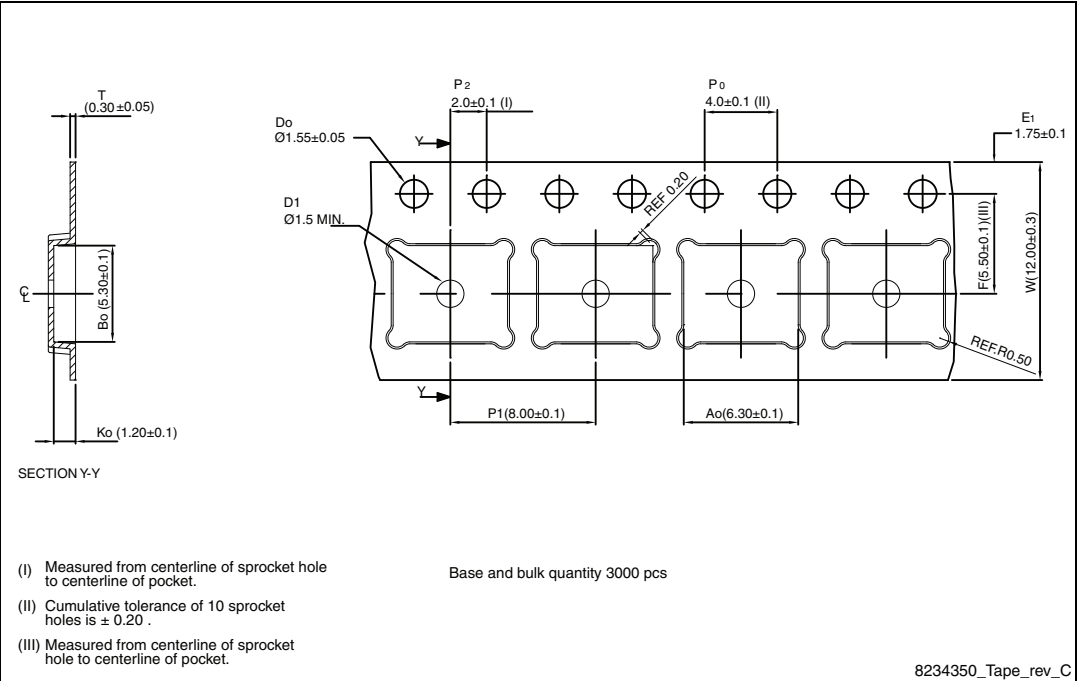
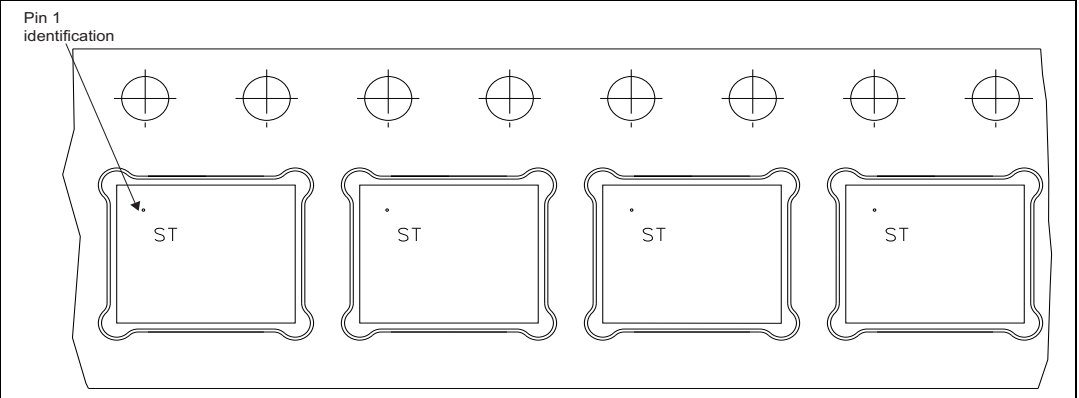
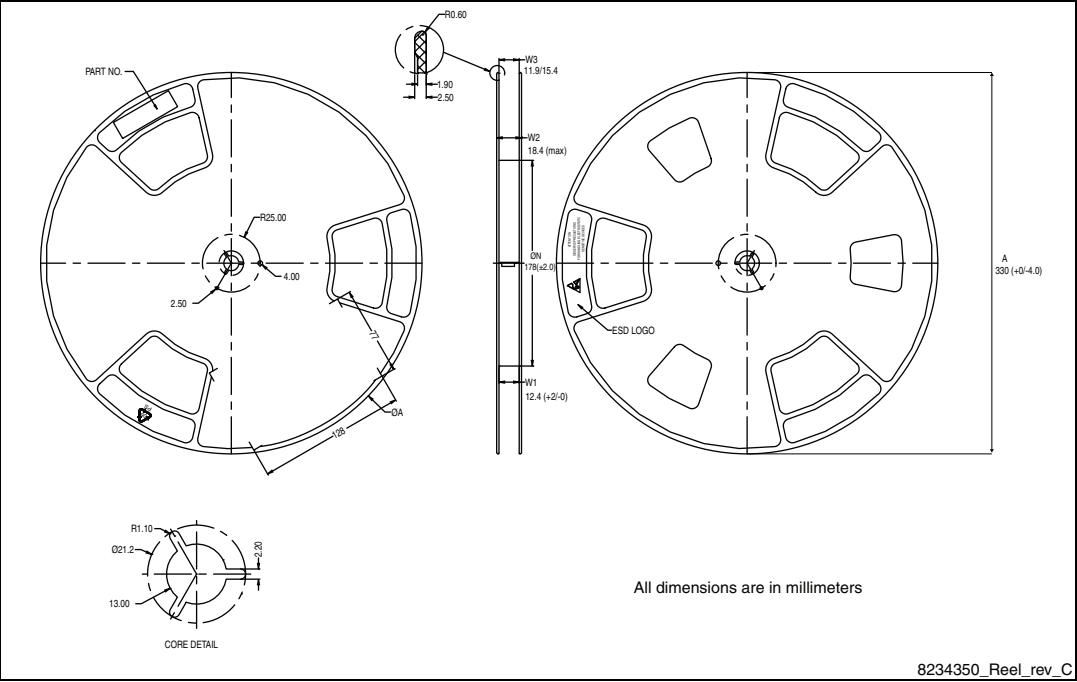


Figure 22. PowerFLAT™ 5x6 package orientation in carrier tape.



a. All dimensions are in millimeters.

Figure 23. PowerFLAT™ 5x6 reel



6 Revision history

Table 9. Document revision history

Date	Revision	Changes
24-Jan-2011	1	First release.
01-Jul-2011	2	Document status promoted from preliminary data to datasheet.
27-Apr-2012	3	Added E_{AS} value in Table 2: Absolute maximum ratings . Updated Table 3: Thermal resistance , Table 4: On/off states , Table 5: Dynamic and Table 7: Source drain diode . Minor text changes.
13-Feb-2013	4	– Added: Section 5: Packaging mechanical data . – Updated Section 4: Package mechanical data .

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