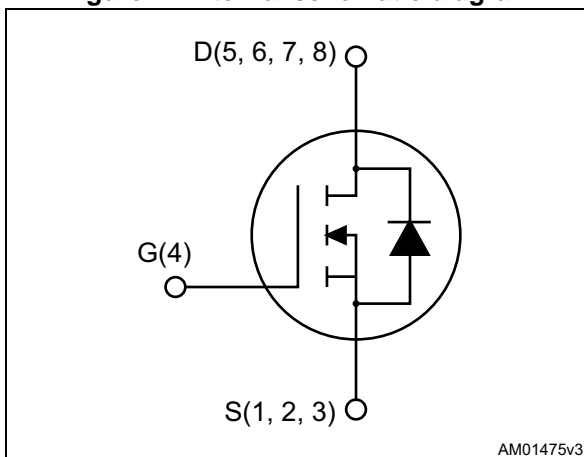


## N-channel 30 V, 0.0076 $\Omega$ typ., 56 A STripFET™ H5 Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet — production data



Figure 1. Internal schematic diagram



### Features

Order code	$V_{DS}$	$R_{DS(on) \max}$	$I_D$
STL56N3LLH5	30 V	0.009 $\Omega$	56 A

- Low on-resistance  $R_{DS(on)}$
- High avalanche ruggedness
- Low gate drive power loss

### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using STMicroelectronics' STripFET™ H5 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.

Table 1. Device summary

Order code	Marking	Package	Packaging
STL56N3LLH5	56N3LH5	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	+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
$I_{DM}^{(1)(3)}$	Drain current (pulsed)	224	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
$E_{AS}^{(4)}$	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  $T_j = 25\text{ °C}$ ,  $I_D = 56\text{ A}$ ,  $V_{DD} = 50\text{ V}$

**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 1inch<sup>2</sup>, 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	$V_{GS} = 0, I_D = 250\ \mu A$	30			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 30\ V,$			1	$\mu A$
		$V_{GS} = 0$ $V_{DS} = 30\ V, T_C = 125\text{ °C}$			10	$\mu A$
$I_{GSS}$	Gate body leakage current	$V_{DS} = 0, V_{GS} = +22 / -20\ V$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu A$	1		2.5	V
$R_{DS(on)}$	Static drain-source on- resistance	$V_{GS} = 10\ V, I_D = 7.5\ A$		0.0076	0.009	$\Omega$
		$V_{GS} = 4.5\ V, I_D = 7.5\ A$		0.0099	0.0112	$\Omega$

**Table 5. Dynamic**

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

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD}=15\text{ V}$ , $I_D=7.5\text{ A}$ , $R_G=4.7\ \Omega$ , $V_{GS}=10\text{ V}$ <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		-		56	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		224	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  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

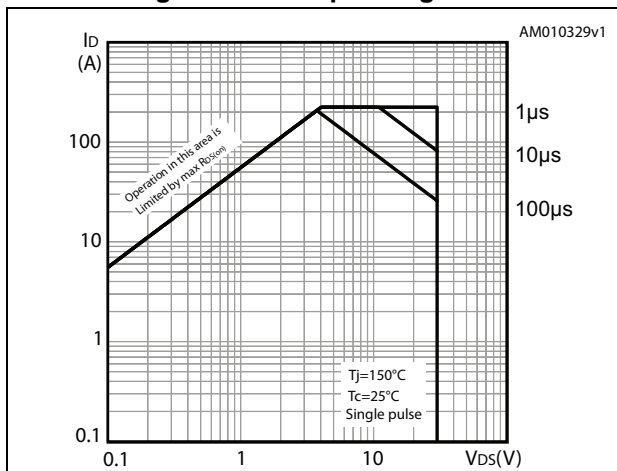


Figure 3. Thermal impedance

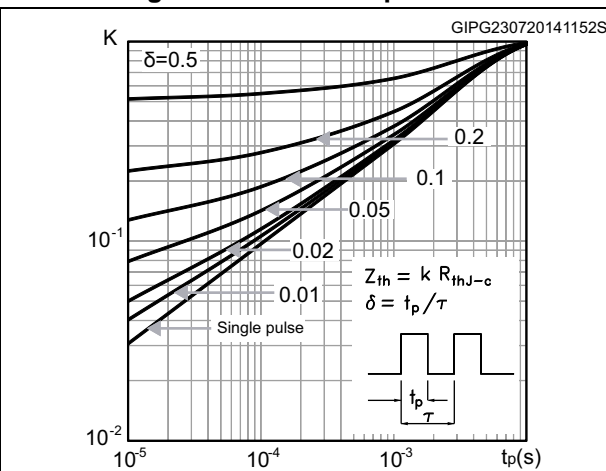


Figure 4. Output characteristics

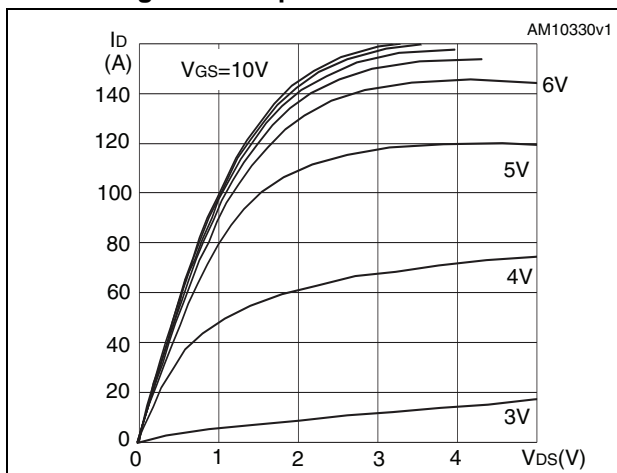


Figure 5. Transfer characteristics

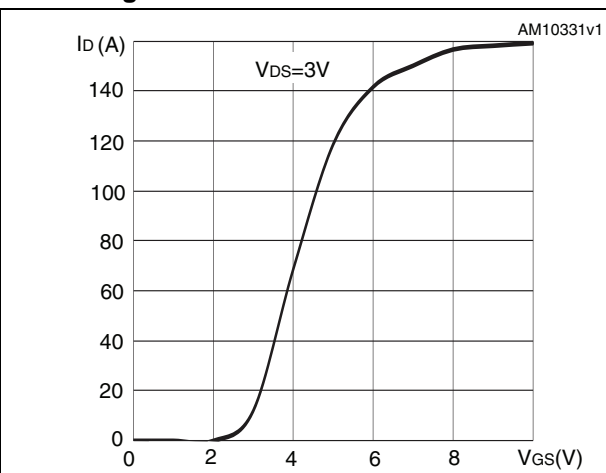


Figure 6. Normalized  $V_{(BR)DSS}$  vs temperature

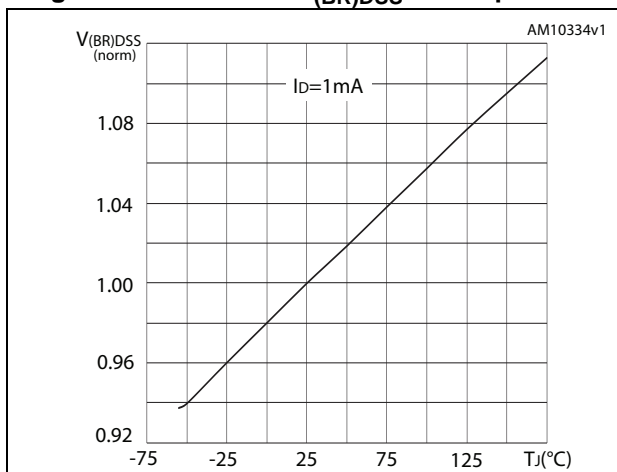


Figure 7. Static drain-source on-resistance

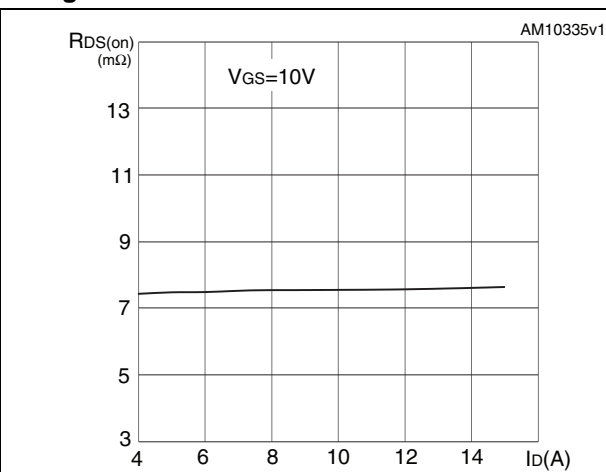


Figure 8. Gate charge vs gate-source voltage

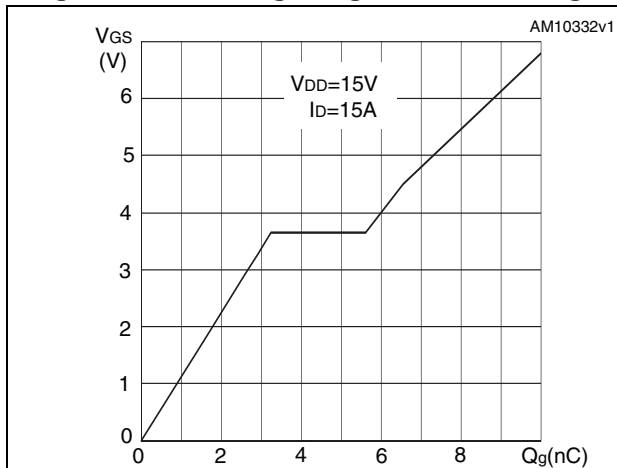


Figure 9. Capacitance variations

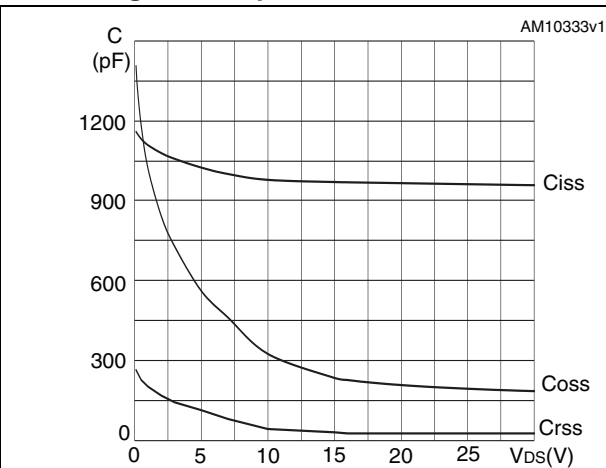


Figure 10. Normalized gate threshold voltage vs temperature

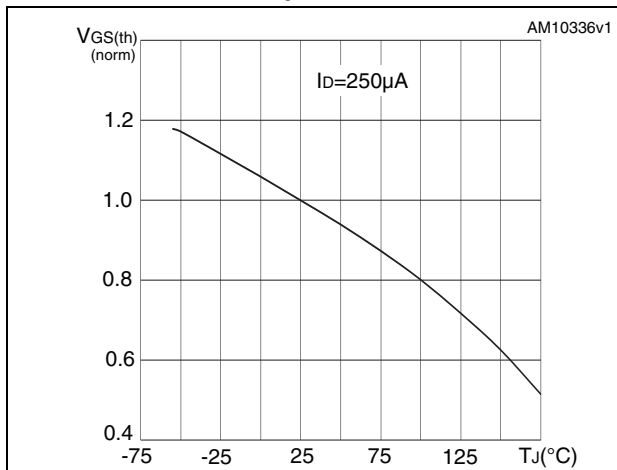


Figure 11. Normalized on-resistance vs temperature

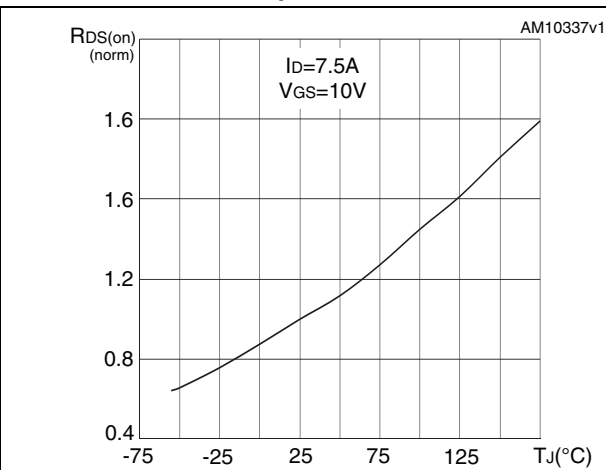
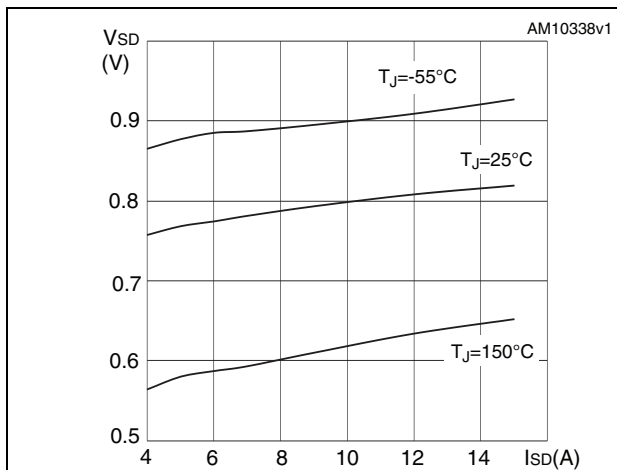


Figure 12. Source-drain diode forward characteristics



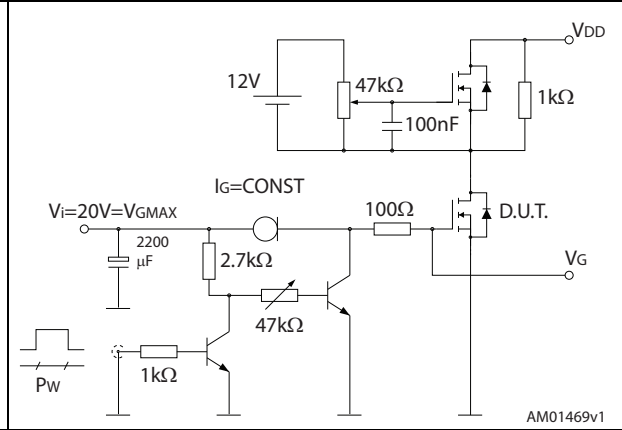
### 3 Test circuits

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



AM01468v1

**Figure 14. Gate charge test circuit**



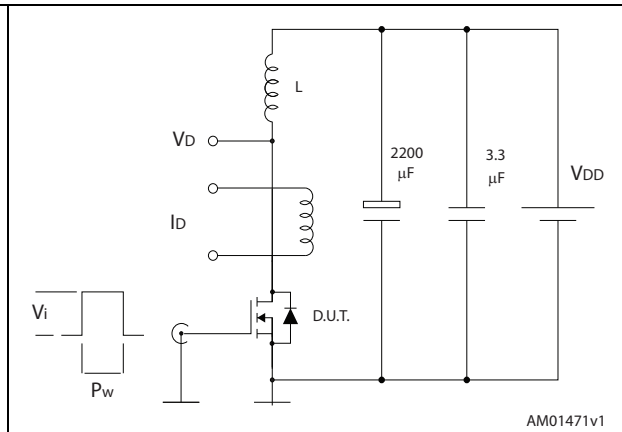
AM01469v1

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



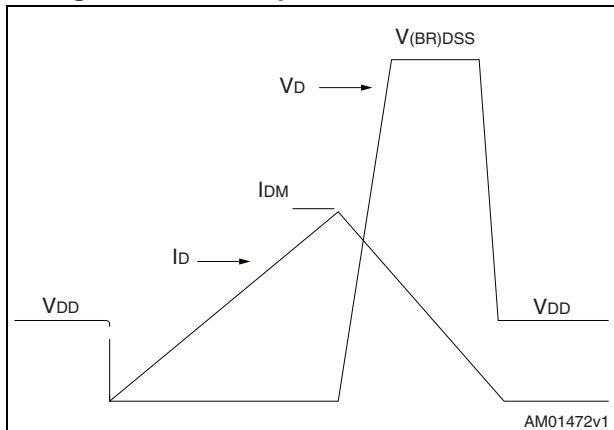
AM01470v1

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



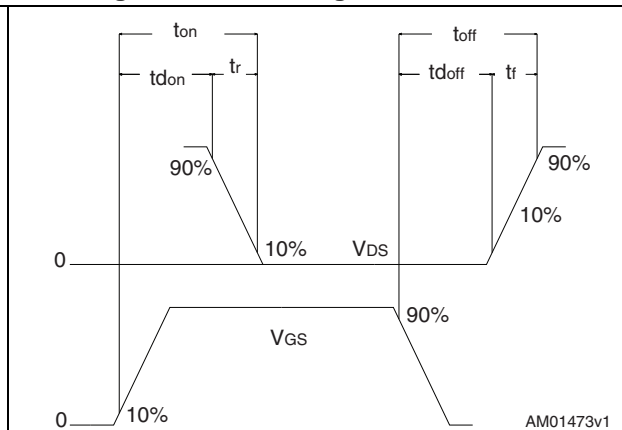
AM01471v1

**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-R drawing

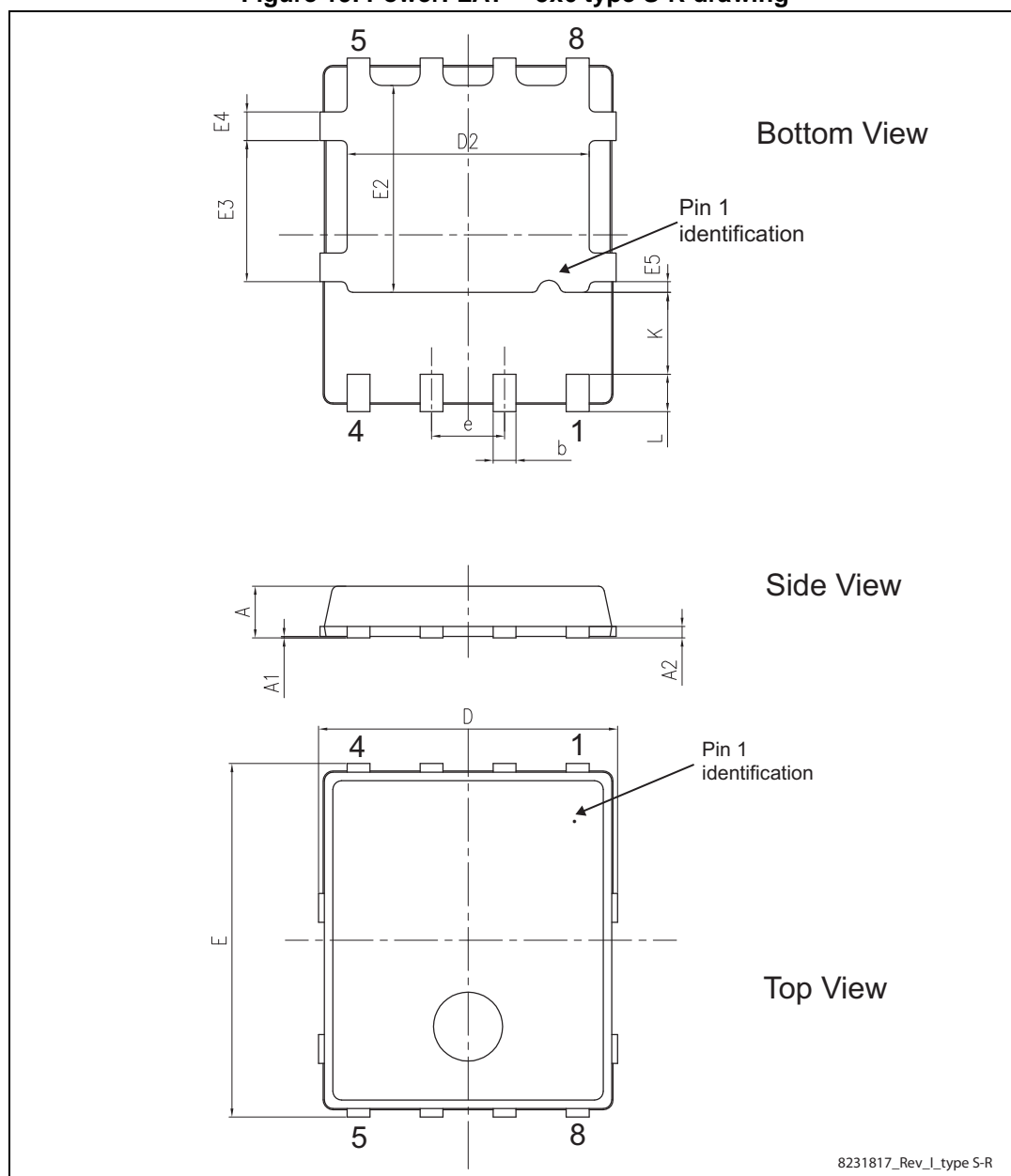
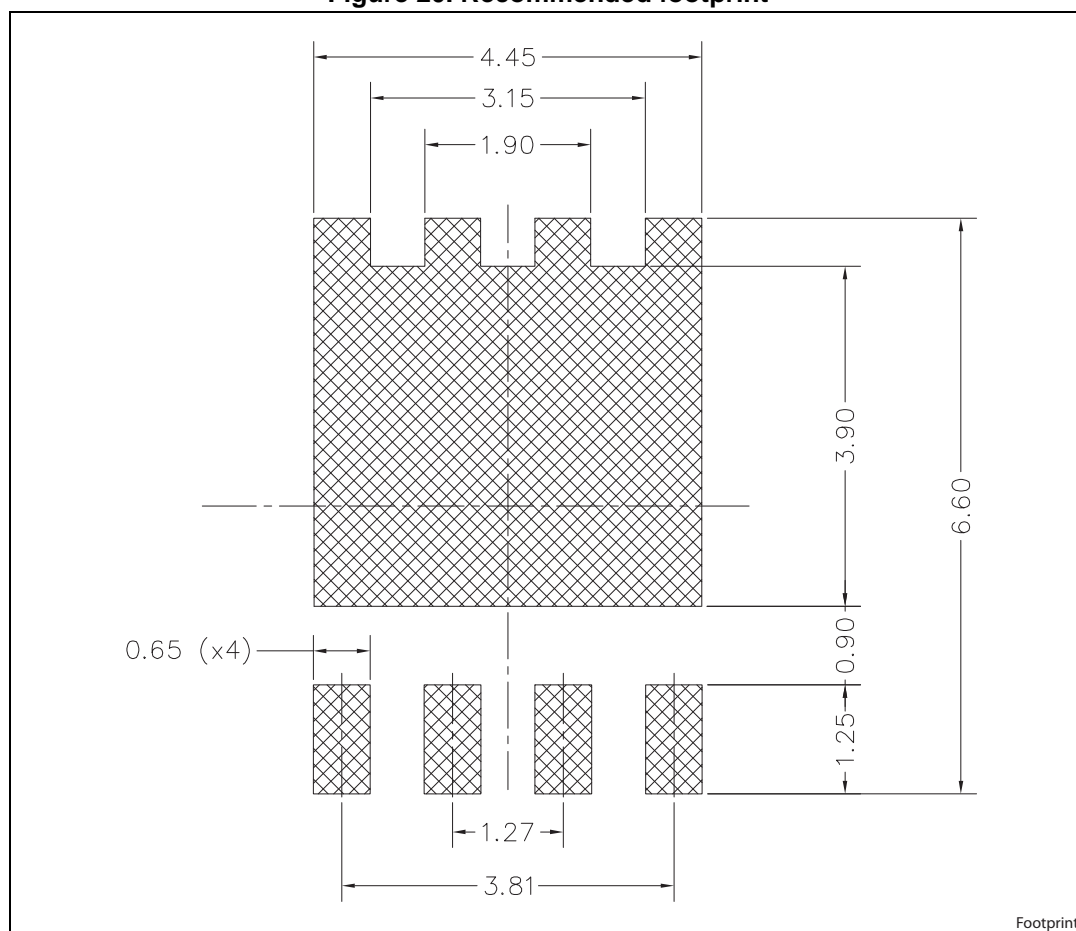


Table 8. PowerFLAT 5x6 type S-R mechanical data

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
D2	4.11		4.31
E	5.95	6.15	6.35
e		1.27	
E2	3.50		3.70
E3	2.35		2.55
E4	0.40		0.60
E5	0.08		0.28
K	1.275		1.575
L	0.60		0.80

Figure 20. Recommended footprint



Note: All dimensions are in mm

# 5 Packaging mechanical data

Figure 21. PowerFLAT™ 5x6 tape<sup>(a)</sup>

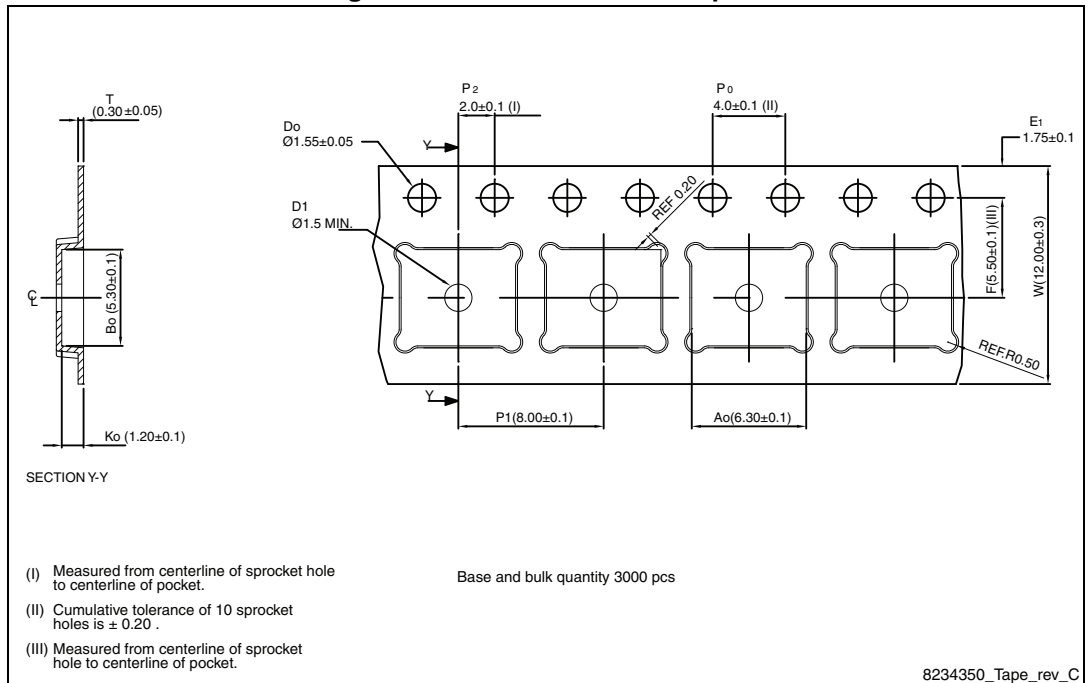
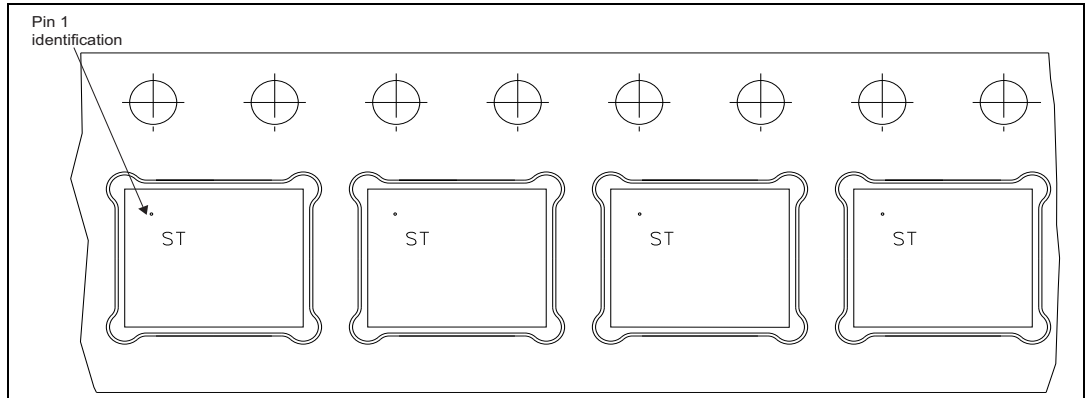
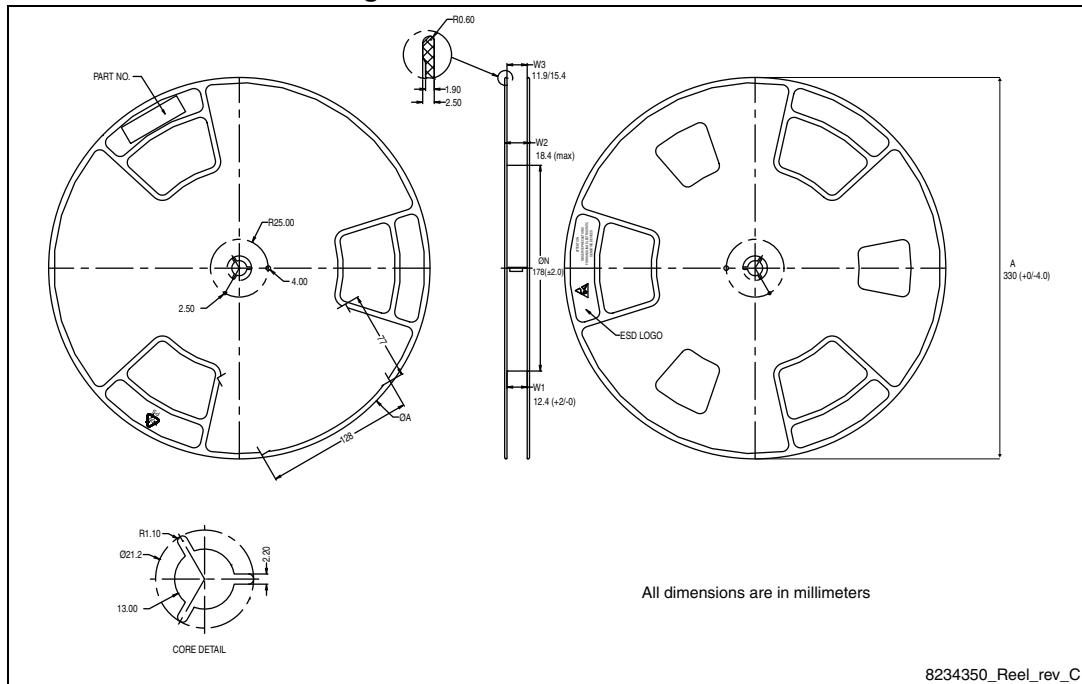


Figure 22. PowerFLAT™ 5x6 package orientation in carrier tape.



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 <a href="#">Table 2: Absolute maximum ratings</a> . Updated <a href="#">Table 3: Thermal resistance</a> , <a href="#">Table 4: On/off states</a> , <a href="#">Table 5: Dynamic</a> and <a href="#">Table 7: Source drain diode</a> . Minor text changes.
13-Feb-2013	4	– Added: <a href="#">Section 5: Packaging mechanical data</a> . – Updated <a href="#">Section 4: Package mechanical data</a> .
25-Jul-2014	5	– Modified: title, features and description in cover page – Modified: $I_{SD}$ and $I_{SDM}$ max values in <a href="#">Table 7</a> – Updated: <a href="#">Figure 2</a> and <a href="#">3</a> – Updated: <a href="#">Figure 13, 14, 15</a> and <a href="#">16</a> – Updated: <a href="#">Section 4: Package mechanical data</a> – Minor text changes

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