

## N-channel 650 V, 0.099 $\Omega$ typ., 22.5 A MDmesh™ V Power MOSFET in PowerFLAT™ 8x8 HV package

Datasheet - production data

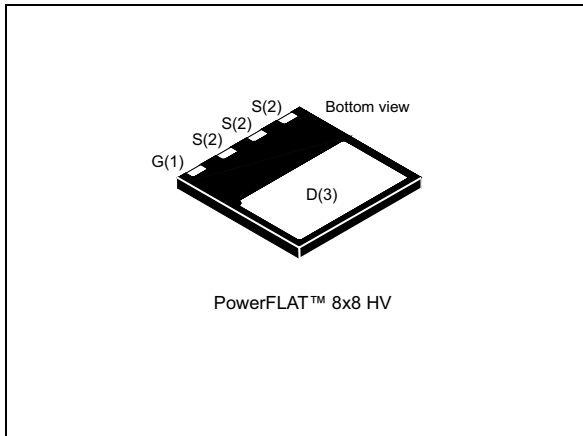
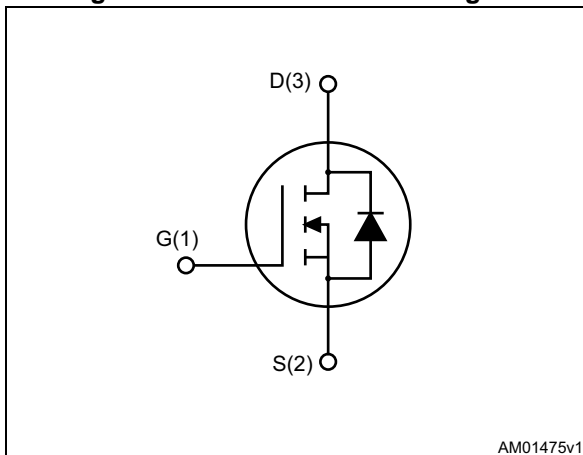


Figure 1. Internal schematic diagram



### Features

Order code	$V_{DS} @ T_{Jmax}$	$R_{DS(on) max}$	$I_D$
STL34N65M5	710 V	0.120 $\Omega$	22.5 A <sup>(1)</sup>

1. The value is rated according to  $R_{thj-case}$  and limited by package.

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

### Applications

- Switching applications

### Description

This device is an N-channel MDmesh™ V Power MOSFET based on an innovative proprietary vertical process technology, which is combined with STMicroelectronics' well-known PowerMESH™ horizontal layout structure. The resulting product has extremely low on-resistance, which is unmatched among silicon-based Power MOSFETs, making it especially suitable for applications which require superior power density and outstanding efficiency.

Table 1. Device summary

Order code	Marking	Package	Packaging
STL34N65M5	34N65M5	PowerFLAT™ 8x8 HV	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	650	V
$V_{GS}$	Gate-source voltage	$\pm 25$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	22.5	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	15	A
$I_{DM}^{(1),(2)}$	Drain current (pulsed)	90	A
$I_D^{(3)}$	Drain current (continuous) at $T_{amb} = 25\text{ }^\circ\text{C}$	3.2	A
$I_D^{(3)}$	Drain current (continuous) at $T_{amb} = 100\text{ }^\circ\text{C}$	2	A
$P_{TOT}^{(3)}$	Total dissipation at $T_{amb} = 25\text{ }^\circ\text{C}$	2.8	W
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	150	W
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ max)	6	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	510	mJ
$dv/dt^{(4)}$	Peak diode recovery voltage slope	15	V/ns
$T_{stg}$	Storage temperature	- 55 to 150	$^\circ\text{C}$
$T_j$	Max. operating junction temperature	150	$^\circ\text{C}$

1. The value is rated according to  $R_{thj-case}$  and limited by package.
2. Pulse width limited by safe operating area.
3. When mounted on FR-4 board of inch<sup>2</sup>, 2oz Cu.
4.  $I_{SD} \leq 22.5\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DS(peak)} < V_{(BR)DSS}$ ,  $V_{DD} = 400\text{ V}$ .

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.83	$^\circ\text{C}/\text{W}$
$R_{thj-amb}^{(1)}$	Thermal resistance junction-ambient max	45	$^\circ\text{C}/\text{W}$

1. When mounted on FR-4 board of inch<sup>2</sup>, 2oz Cu.

## 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	$I_D = 1\text{ mA}$ , $V_{GS} = 0$	650			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 650\text{ V}$ $V_{DS} = 650\text{ V}$ , $T_C = 125\text{ °C}$			1 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 25\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$ , $I_D = 12\text{ A}$		0.099	0.120	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	2700	-	pF
$C_{oss}$	Output capacitance		-	75	-	pF
$C_{rss}$	Reverse transfer capacitance		-	6.3	-	pF
$C_{o(er)}^{(1)}$	Equivalent output capacitance energy related	$V_{GS} = 0$ , $V_{DS} = 0\text{ to }80\% V_{(BR)DSS}$	-	63	-	pF
$C_{o(tr)}^{(2)}$	Equivalent output capacitance time related		-	220	-	pF
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	1.95	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 520\text{ V}$ , $I_D = 14\text{ A}$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15</a> )	-	62.5	-	nC
$Q_{gs}$	Gate-source charge		-	17	-	nC
$Q_{gd}$	Gate-drain charge		-	28	-	nC

- $C_{o(er)}^{(1)}$  is a constant capacitance value that gives the same stored energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$
- $C_{o(tr)}^{(2)}$  is a constant capacitance value that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(v)}$	Voltage delay time	$V_{DD} = 400\text{ V}$ , $I_D = 18\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 19</a> )	-	59	-	ns
$t_{r(v)}$	Voltage rise time		-	8.7	-	ns
$t_{f(i)}$	Current fall time		-	7.5	-	ns
$t_{c(off)}$	Crossing time		-	12	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Source-drain current		-		22.5	A
$I_{SDM}^{(1),(2)}$	Source-drain current (pulsed)		-		90	A
$V_{SD}^{(3)}$	Forward on voltage	$I_{SD} = 22.5\text{ A}$ , $V_{GS} = 0$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 22.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ (see <a href="#">Figure 16</a> )	-	330		ns
$Q_{rr}$	Reverse recovery charge		-	5.3		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	32.5		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 22.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ (see <a href="#">Figure 16</a> )	-	412		ns
$Q_{rr}$	Reverse recovery charge		-	7.3		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	35.5		A

1. The value is rated according to  $R_{thj-case}$  and limited by package.
2. Pulse width limited by safe operating area.
3. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

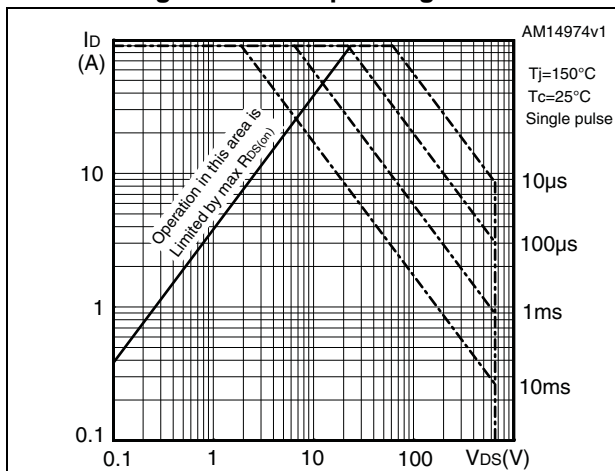


Figure 3. Thermal impedance

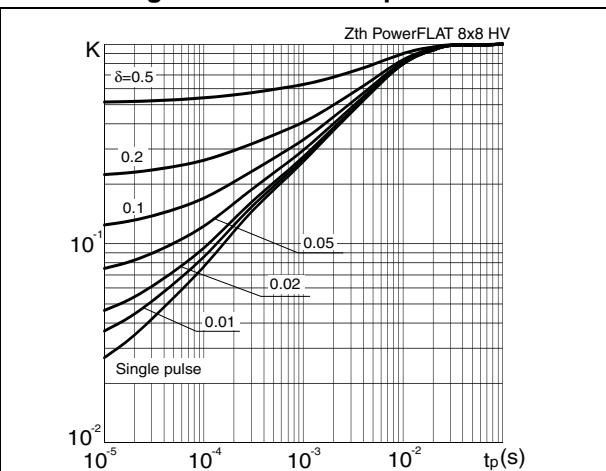


Figure 4. Output characteristics

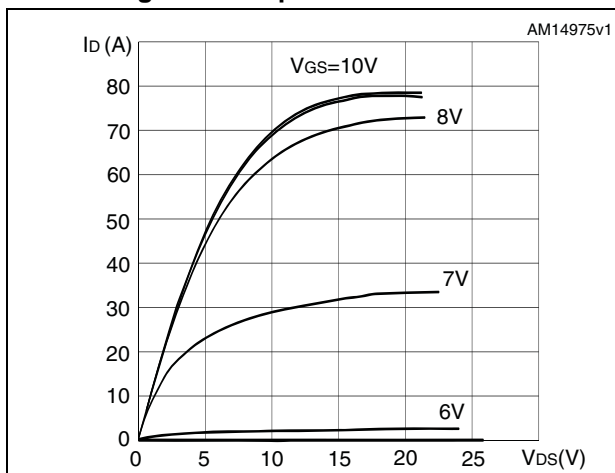


Figure 5. Transfer characteristics

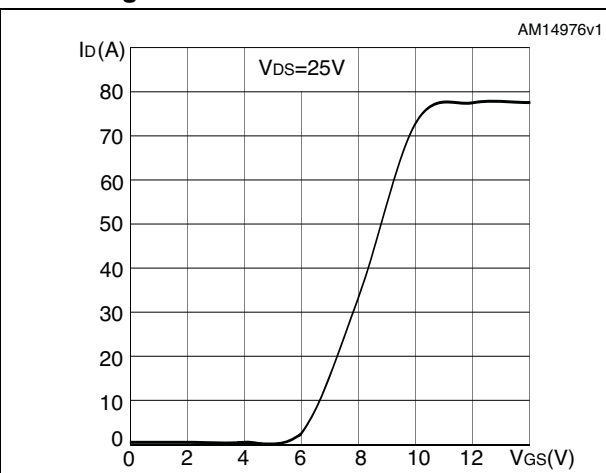


Figure 6. Gate charge vs gate-source voltage

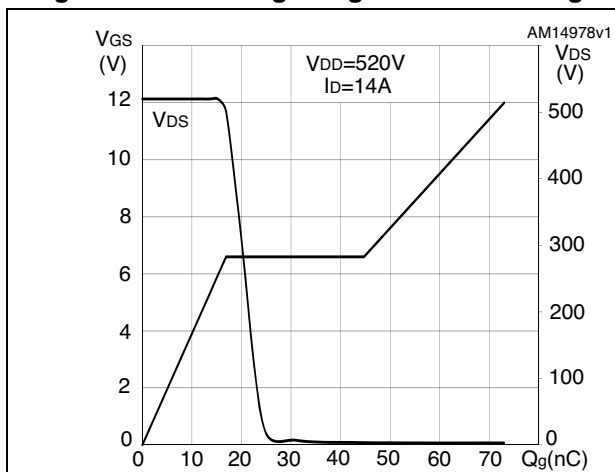


Figure 7. Static drain-source on-resistance

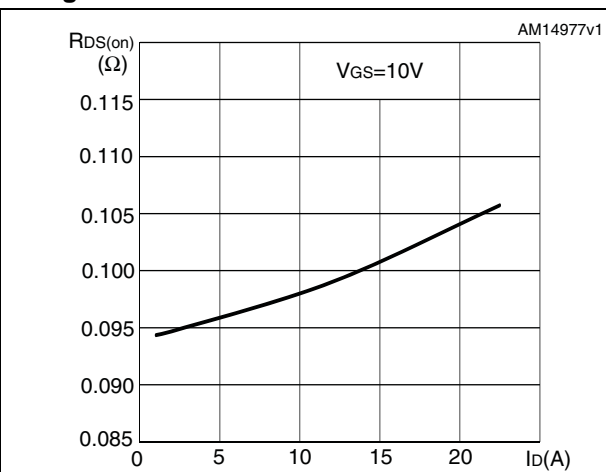


Figure 8. Capacitance variations

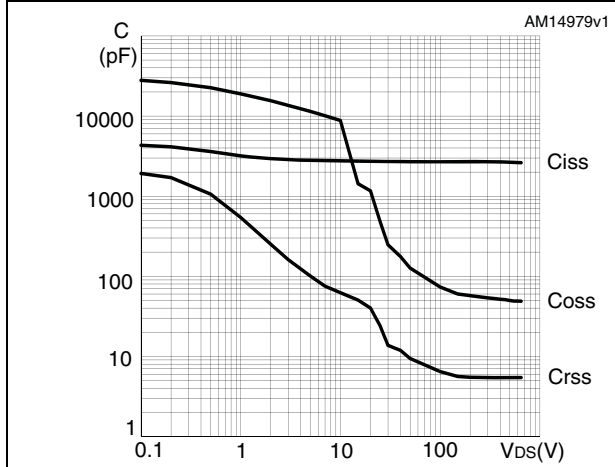


Figure 9. Output capacitance stored energy

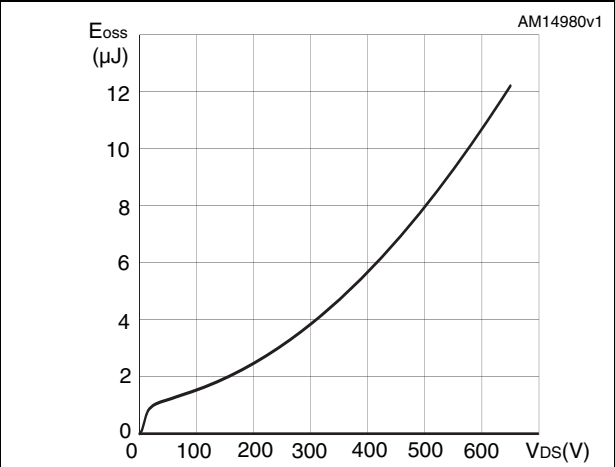


Figure 10. Normalized gate threshold voltage vs temperature

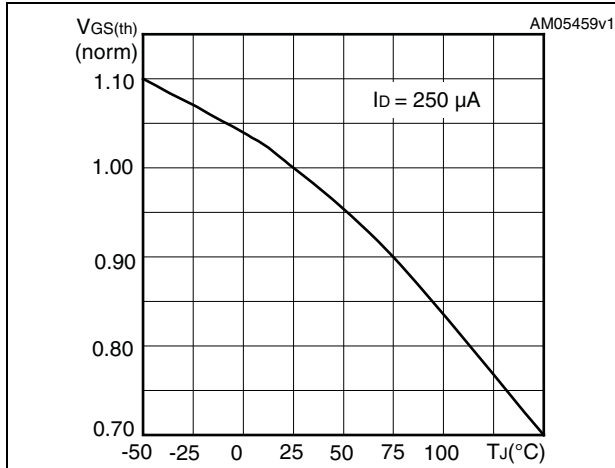


Figure 11. Normalized on-resistance vs temperature

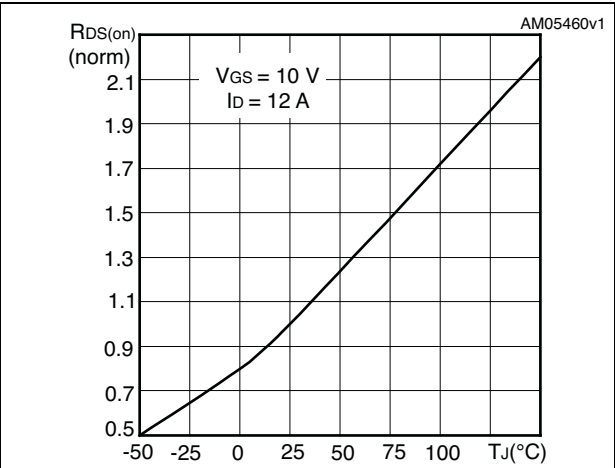


Figure 12. Switching losses vs gate resistance (1)

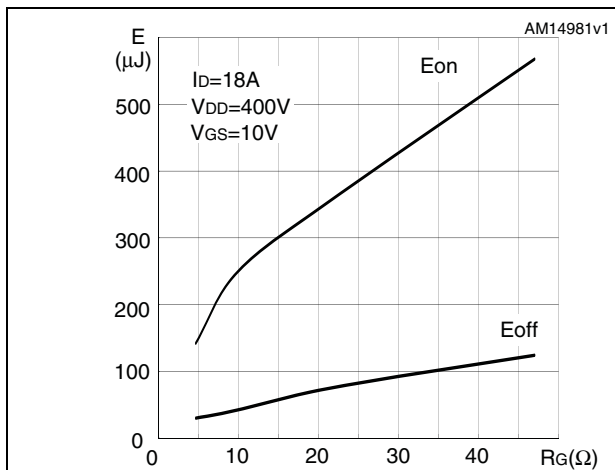
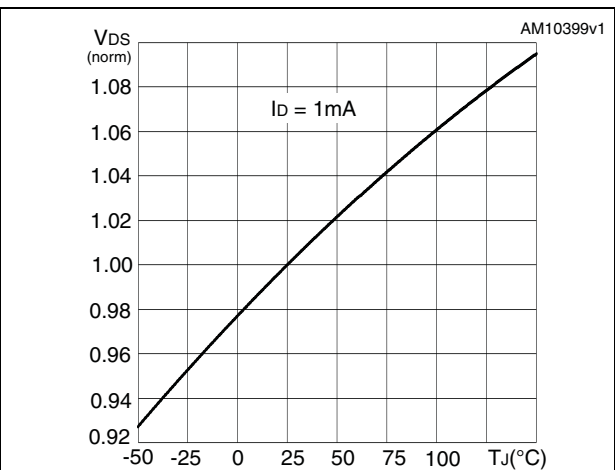


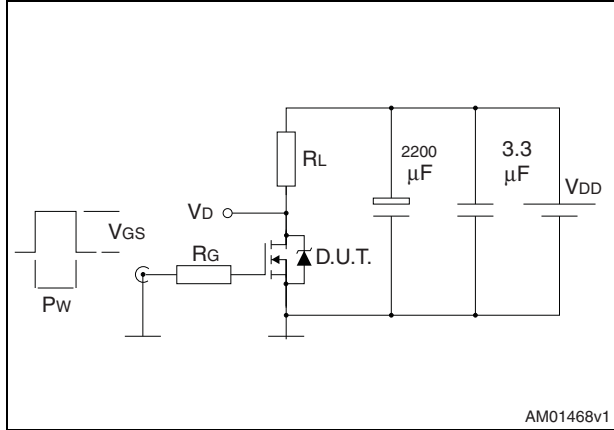
Figure 13. Normalized VDS vs temperature



1. Eon including reverse recovery of a SiC diode

### 3 Test circuits

Figure 14. Switching times test circuit for resistive load



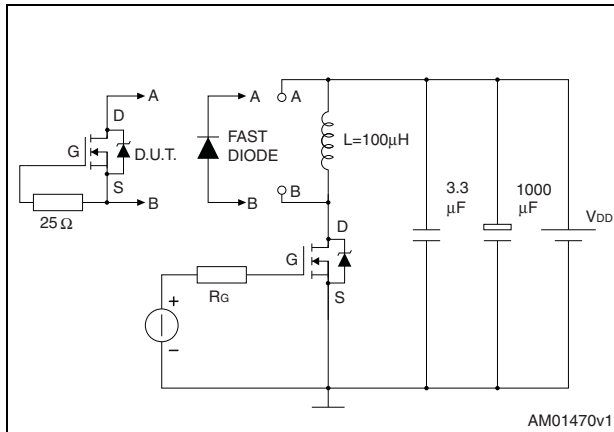
AM01468v1

Figure 15. Gate charge test circuit



AM01469v1

Figure 16. Test circuit for inductive load switching and diode recovery times



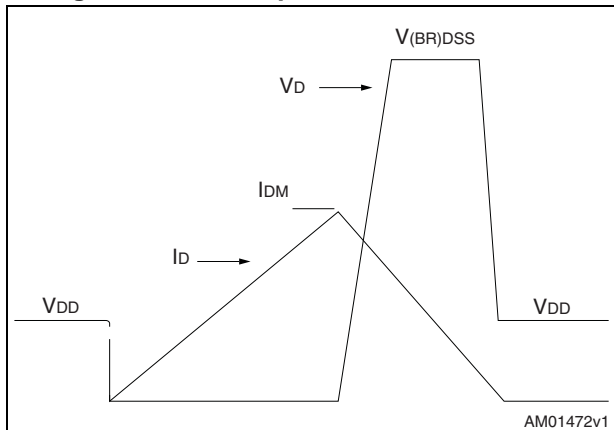
AM01470v1

Figure 17. Unclamped inductive load test circuit



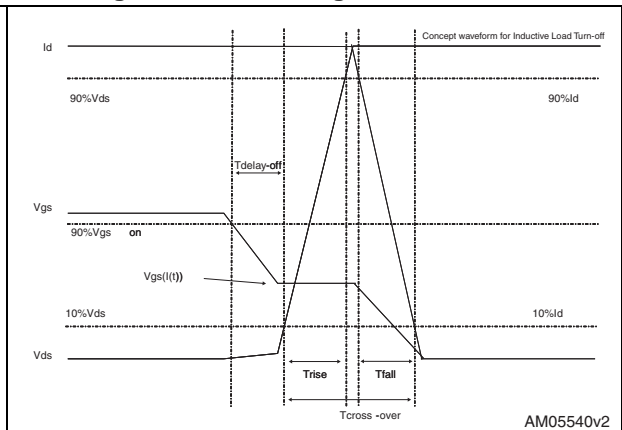
AM01471v1

Figure 18. Unclamped inductive waveform



AM01472v1

Figure 19. Switching time waveform



AM05540v2



## 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 20. PowerFLAT™ 8x8 HV drawing mechanical data

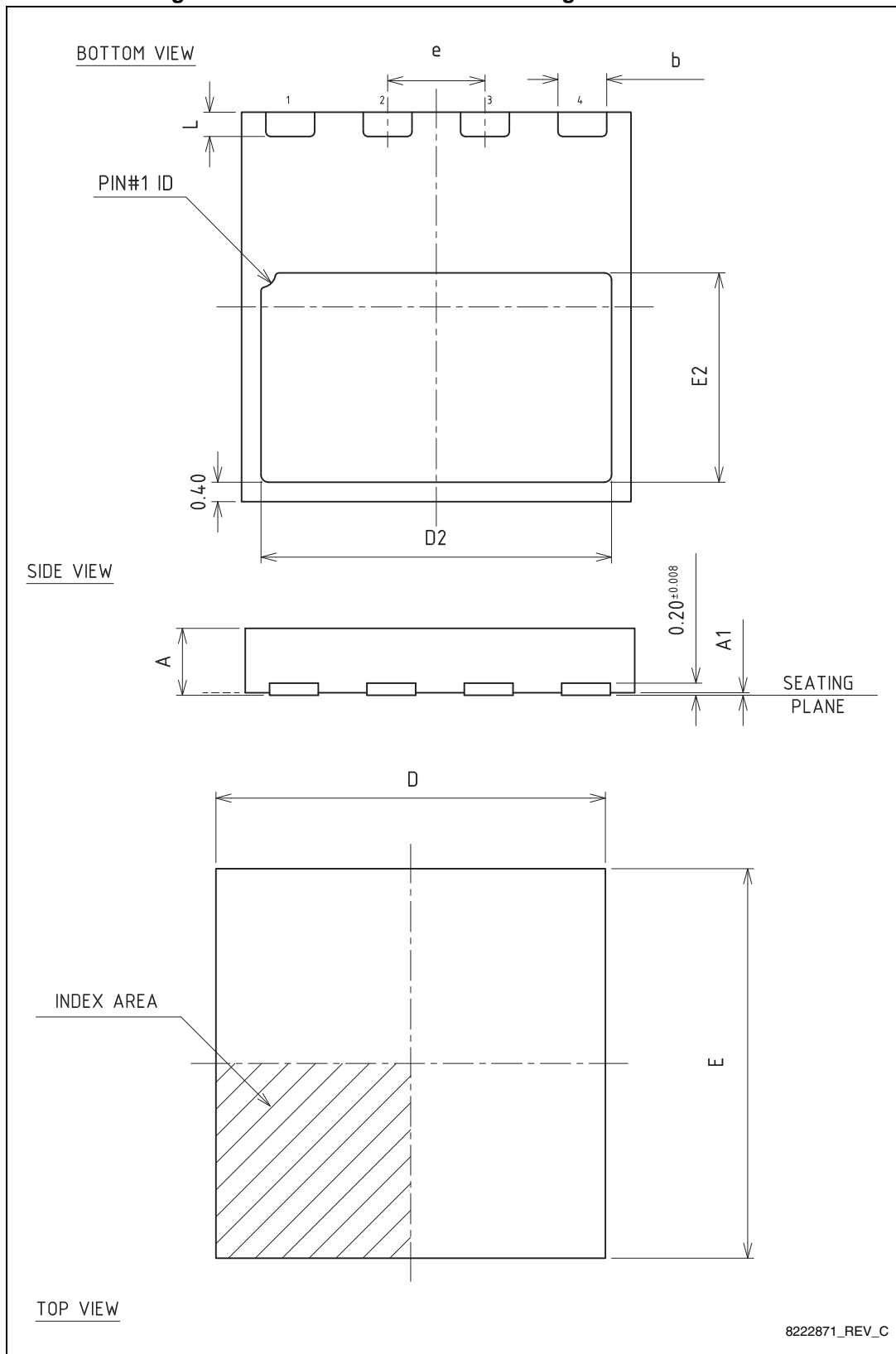
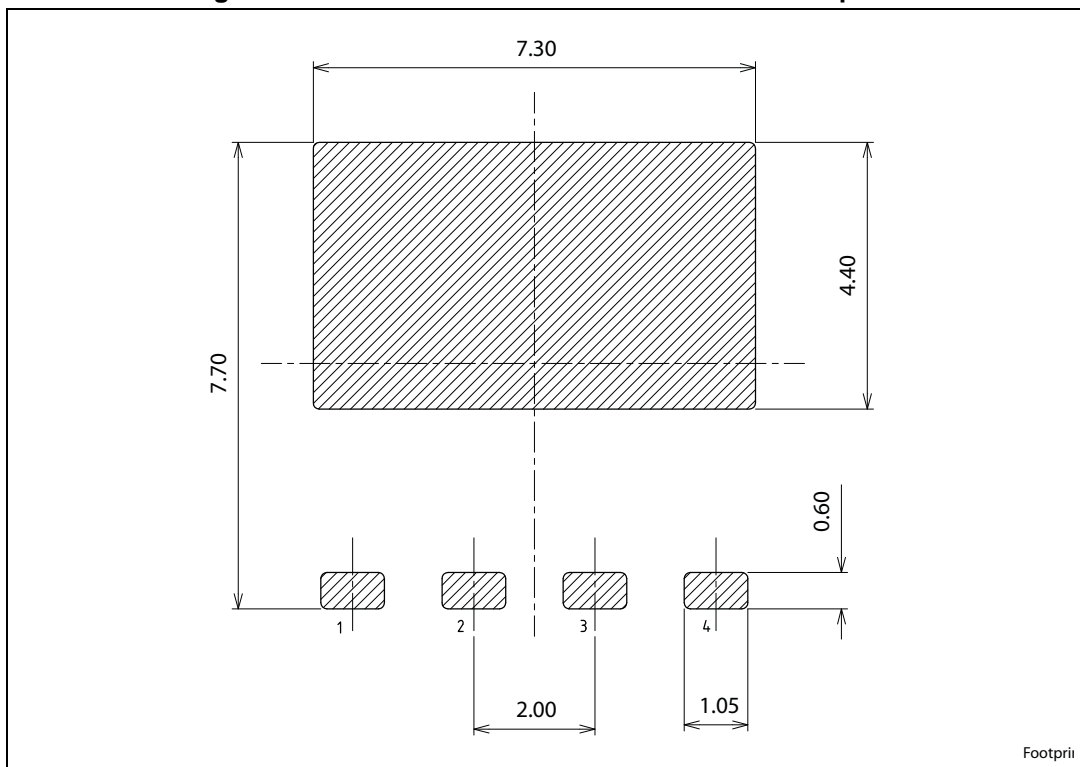


Table 8. PowerFLAT™ 8x8 HV mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80	0.90	1.00
A1	0.00	0.02	0.05
b	0.95	1.00	1.05
D		8.00	
E		8.00	
D2	7.05	7.20	7.30
E2	4.15	4.30	4.40
e		2.00	
L	0.40	0.50	0.60

Figure 21. PowerFLAT™ 8x8 HV recommended footprint



# 5 Packaging mechanical data

Figure 22. PowerFLAT™ 8x8 HV tape

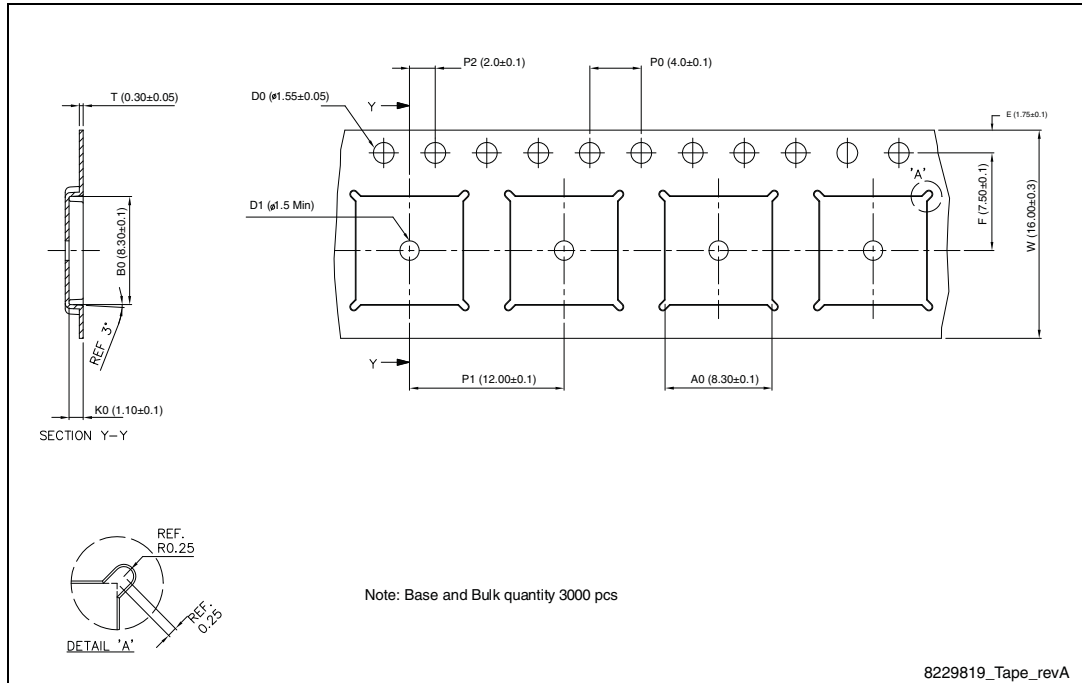


Figure 23. PowerFLAT™ 8x8 HV package orientation in carrier tape.

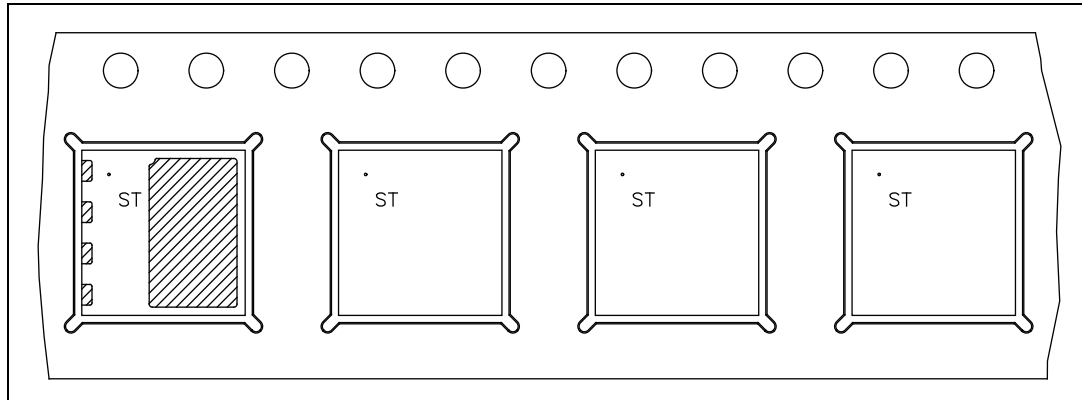
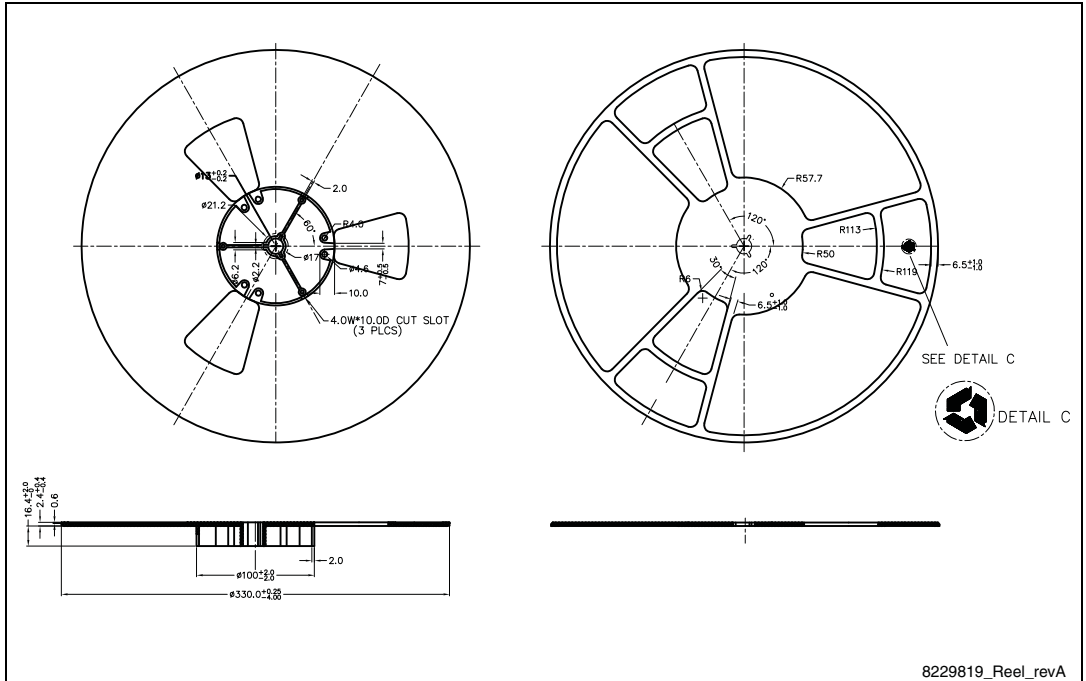


Figure 24. PowerFLAT™ 8x8 HV reel



## 6 Revision history

Table 9. Document revision history

Date	Revision	Changes
07-Apr-2014	1	First release.

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