

## N-channel 650 V, 0.215 $\Omega$ typ., 12.5 A MDmesh™ V Power MOSFET in a PowerFLAT™ 8x8 HV package

Datasheet - production data

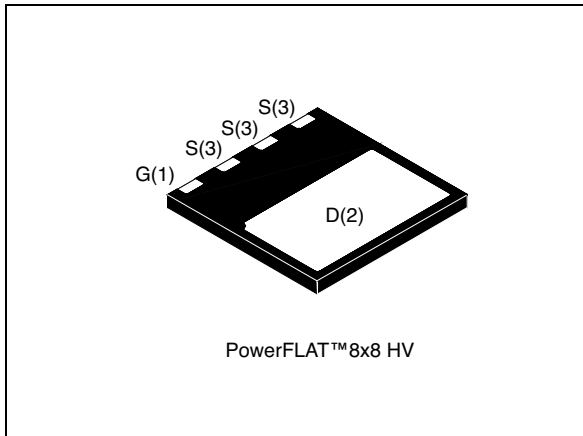
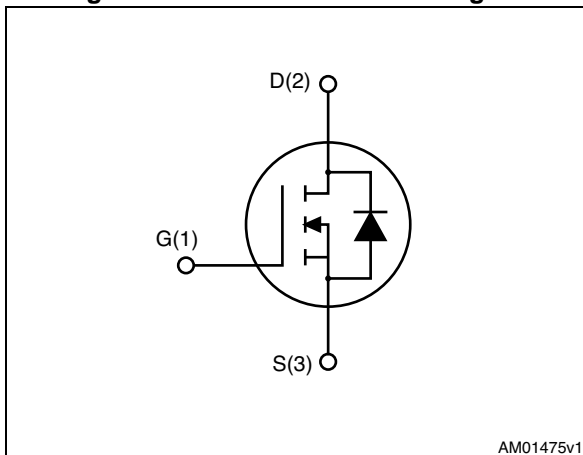


Figure 1. Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)max.</sub>	I <sub>D</sub>
STL19N65M5	710 V	0.240 $\Omega$	12.5 A <sup>(1)</sup>

1. The value is rated according to R<sub>thj-case</sub> and limited by package.

- Worldwide best R<sub>DS(on)</sub> \* area
- Higher V<sub>DSS</sub> rating and high dv/dt capability
- Excellent switching performance

### 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
STL19N65M5	19N65M5	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 $T_C = 25\text{ }^\circ\text{C}$	12.5	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	8.3	A
$I_{DM}^{(1),(2)}$	Drain current (pulsed)	50	A
$I_D^{(3)}$	Drain current (continuous) at $T_{amb} = 25\text{ }^\circ\text{C}$	2.3	A
$I_D^{(3)}$	Drain current (continuous) at $T_{amb} = 100\text{ }^\circ\text{C}$	1.5	A
$P_{TOT}^{(3)}$	Total dissipation at $T_{amb} = 25\text{ }^\circ\text{C}$	2.8	W
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	90	W
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ max)	4	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	210	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  $\text{inch}^2$ , 2oz Cu
4.  $I_{SD} \leq 12.5\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{Peak} \leq V_{(BR)DSS}$ ,  $V_{DD} = 400\text{ V}$ .

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.39	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-amb max	45	$^\circ\text{C}/\text{W}$

## 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 ( $V_{GS} = 0$ )	$I_D = 1\text{ mA}$	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	$V_{GS} = 10\text{ V}, I_D = 7.5\text{ A}$		0.215	0.240	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$	-	1240	-	pF
$C_{oss}$	Output capacitance		-	32	-	pF
$C_{rss}$	Reverse transfer capacitance		-	3	-	pF
$C_{o(er)}^{(1)}$	Equivalent output capacitance energy related	$V_{GS} = 0,$ $V_{DS} = 0\text{ to }80\% V_{(BR)DSS}$	-	30	-	pF
$C_{o(tr)}^{(2)}$	Equivalent capacitance time related		-	99	-	pF
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz open drain}$	-	3	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 520\text{ V}, I_D = 7.5\text{ A},$ $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 16</a> )	-	31	-	nC
$Q_{gs}$	Gate-source charge		-	8	-	nC
$Q_{gd}$	Gate-drain charge		-	14	-	nC

- $C_{oss,eq}$  time related is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$
- $C_{oss,eq}$  energy related is defined as a constant equivalent capacitance giving the same stored energy as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(v)}$	Voltage delay time	$V_{DD} = 400\text{ V}$ , $I_D = 9.5\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 17</a> and <a href="#">20</a> )	-	36	-	ns
$t_{r(v)}$	Voltage rise time		-	7	-	ns
$t_{f(i)}$	Current fall time		-	9	-	ns
$t_{c(off)}$	Crossing time		-	11	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Source-drain current		-		12.5	A
$I_{SDM}^{(1),(2)}$	Source-drain current (pulsed)		-		50	A
$V_{SD}^{(3)}$	Forward on voltage	$I_{SD} = 15\text{ A}$ , $V_{GS} = 0$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 15\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ (see <a href="#">Figure 17</a> )	-	290		ns
$Q_{rr}$	Reverse recovery charge		-	3.4		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	23.5		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 15\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ (see <a href="#">Figure 17</a> )	-	352		ns
$Q_{rr}$	Reverse recovery charge		-	4		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	24		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

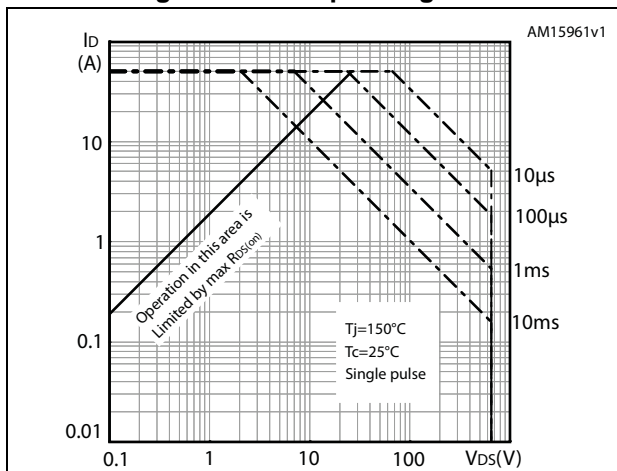


Figure 3. Thermal impedance

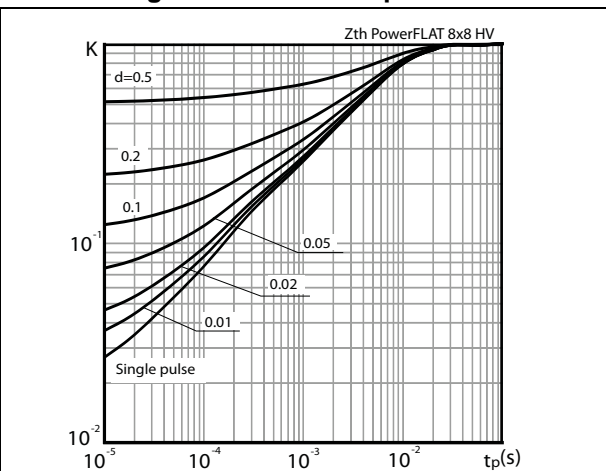


Figure 4. Output characteristics

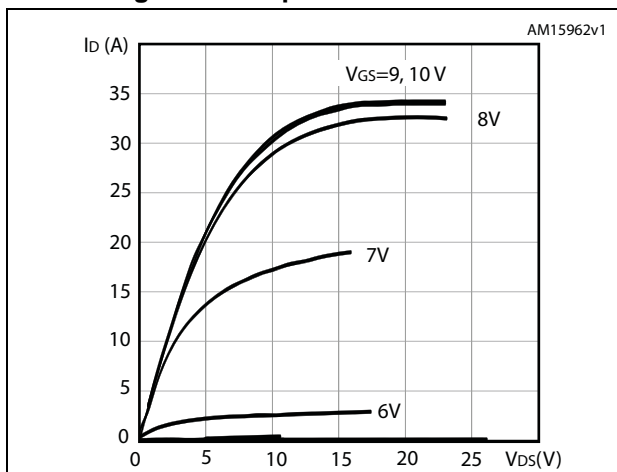


Figure 5. Transfer characteristics

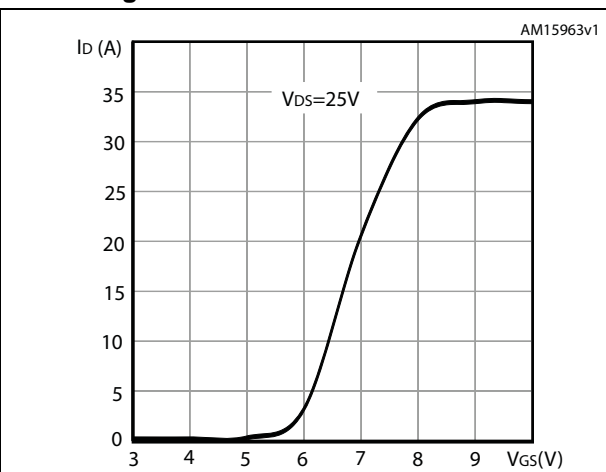


Figure 6. Gate charge vs gate-source voltage

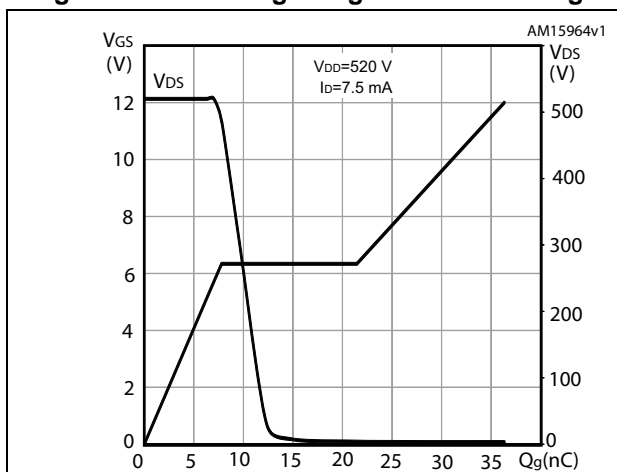


Figure 7. Static drain-source on-resistance

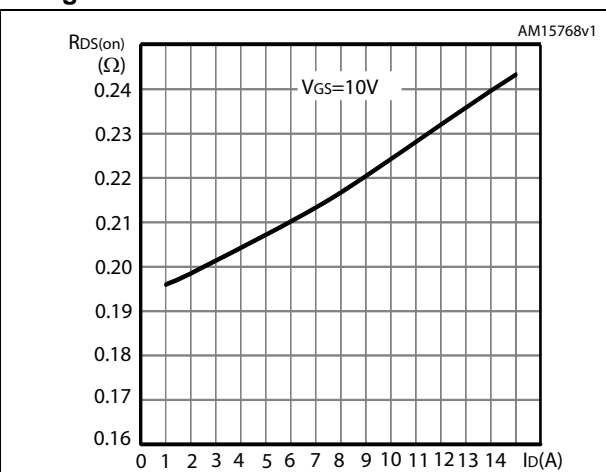


Figure 8. Capacitance variations

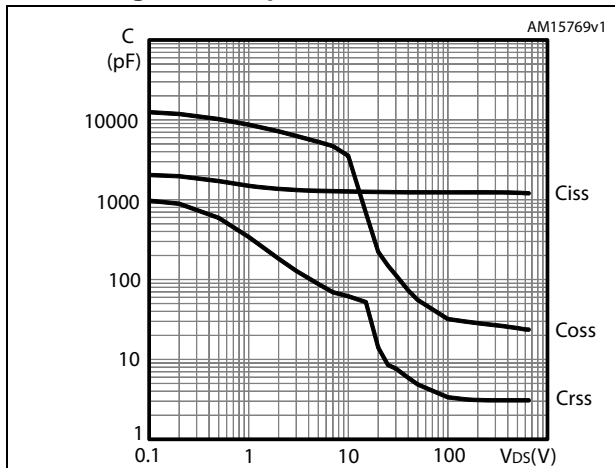


Figure 9. Output capacitance stored energy

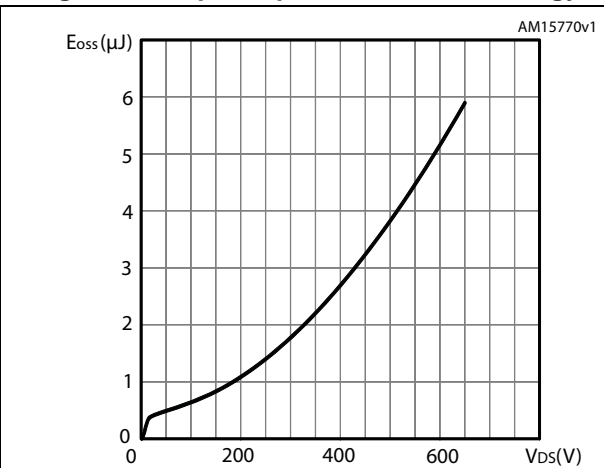


Figure 10. Normalized gate threshold voltage vs. temperature

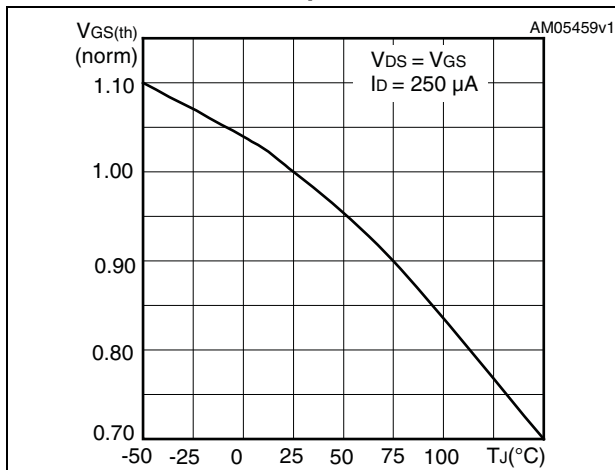


Figure 11. Normalized on-resistance vs. temperature

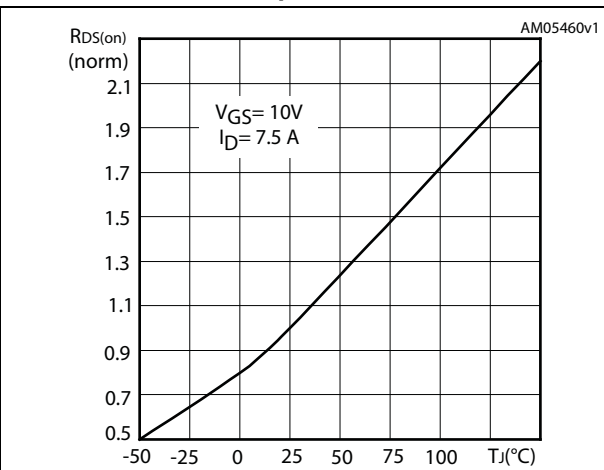


Figure 12. Drain-source diode forward characteristics

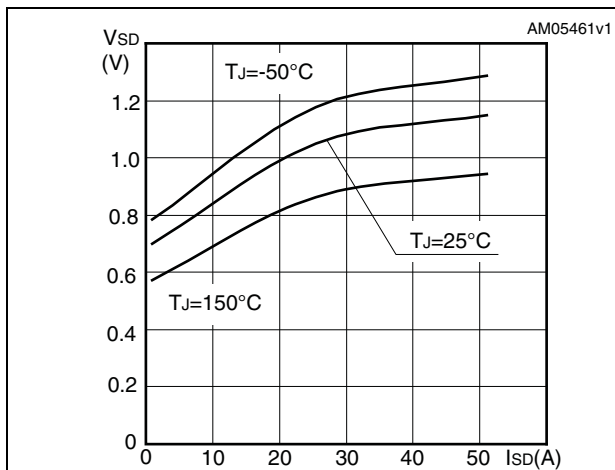


Figure 13. Normalized VDS vs. temperature

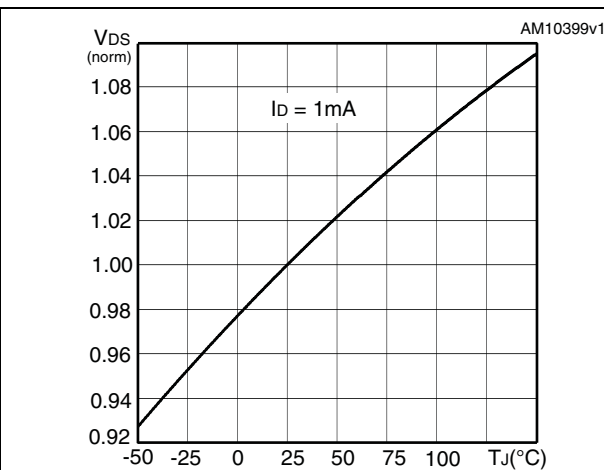
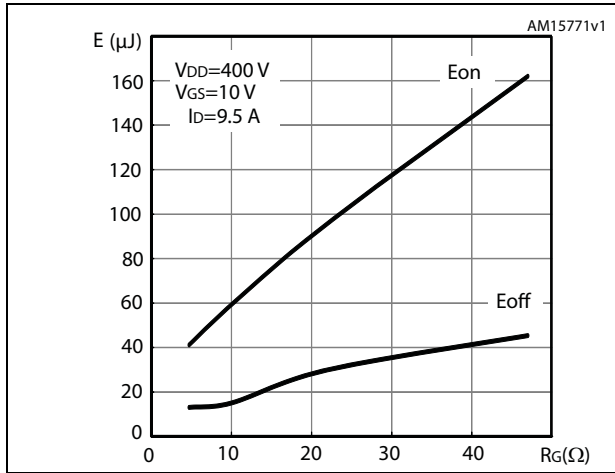


Figure 14. Switching losses vs gate resistance (1)

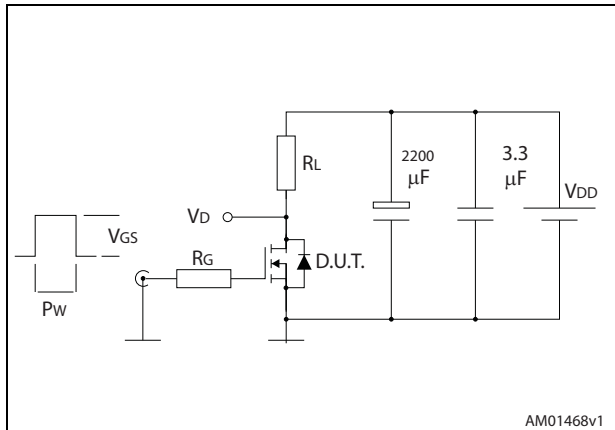


1.  $E_{on}$  including reverse recovery of a SiC diode



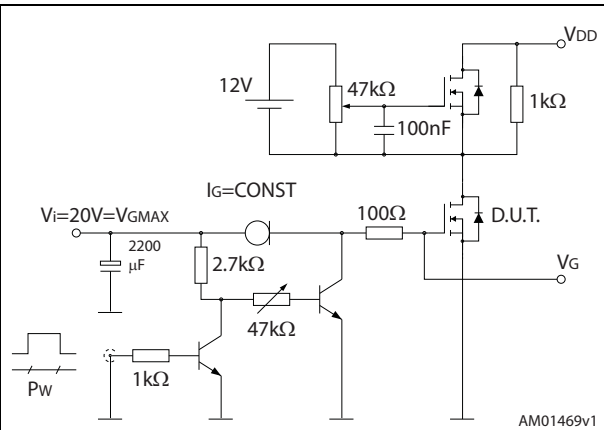
### 3 Test circuits

Figure 15. Switching times test circuit for resistive load



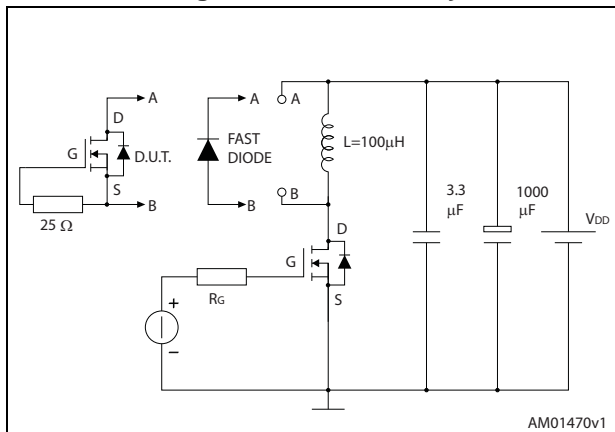
AM01468v1

Figure 16. Gate charge test circuit



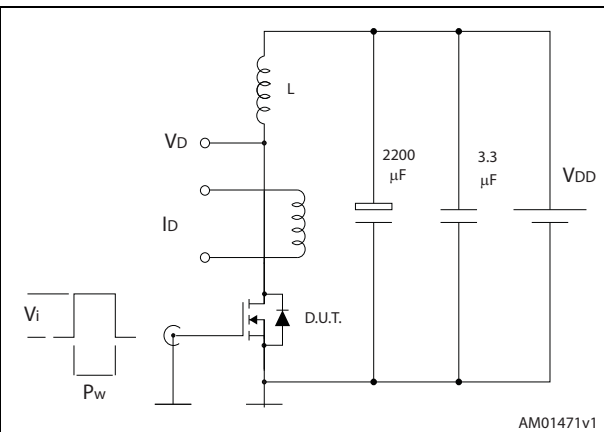
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Figure 17. Test circuit for inductive load switching and diode recovery times



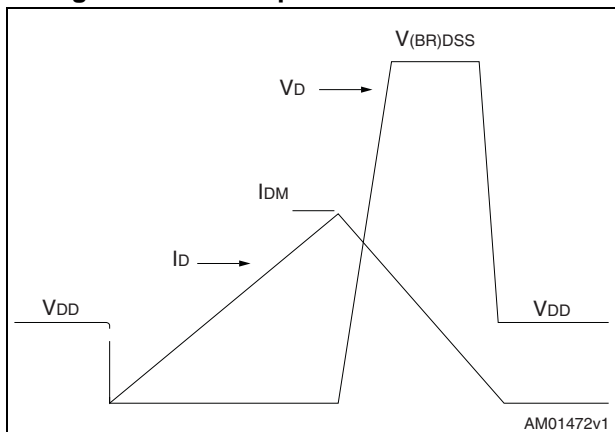
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Figure 18. Unclamped inductive load test circuit



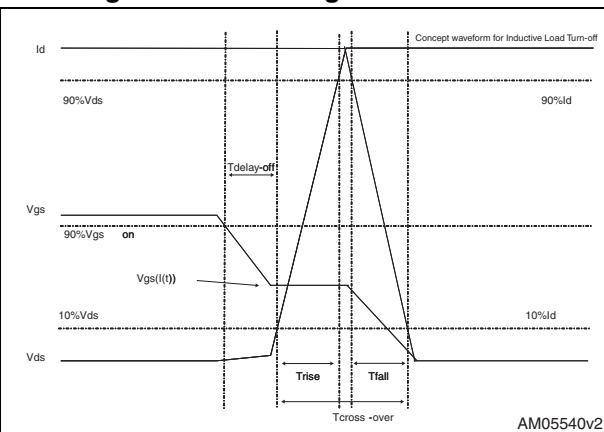
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Figure 19. Unclamped inductive waveform



AM01472v1

Figure 20. Switching time waveform



AM05540v2

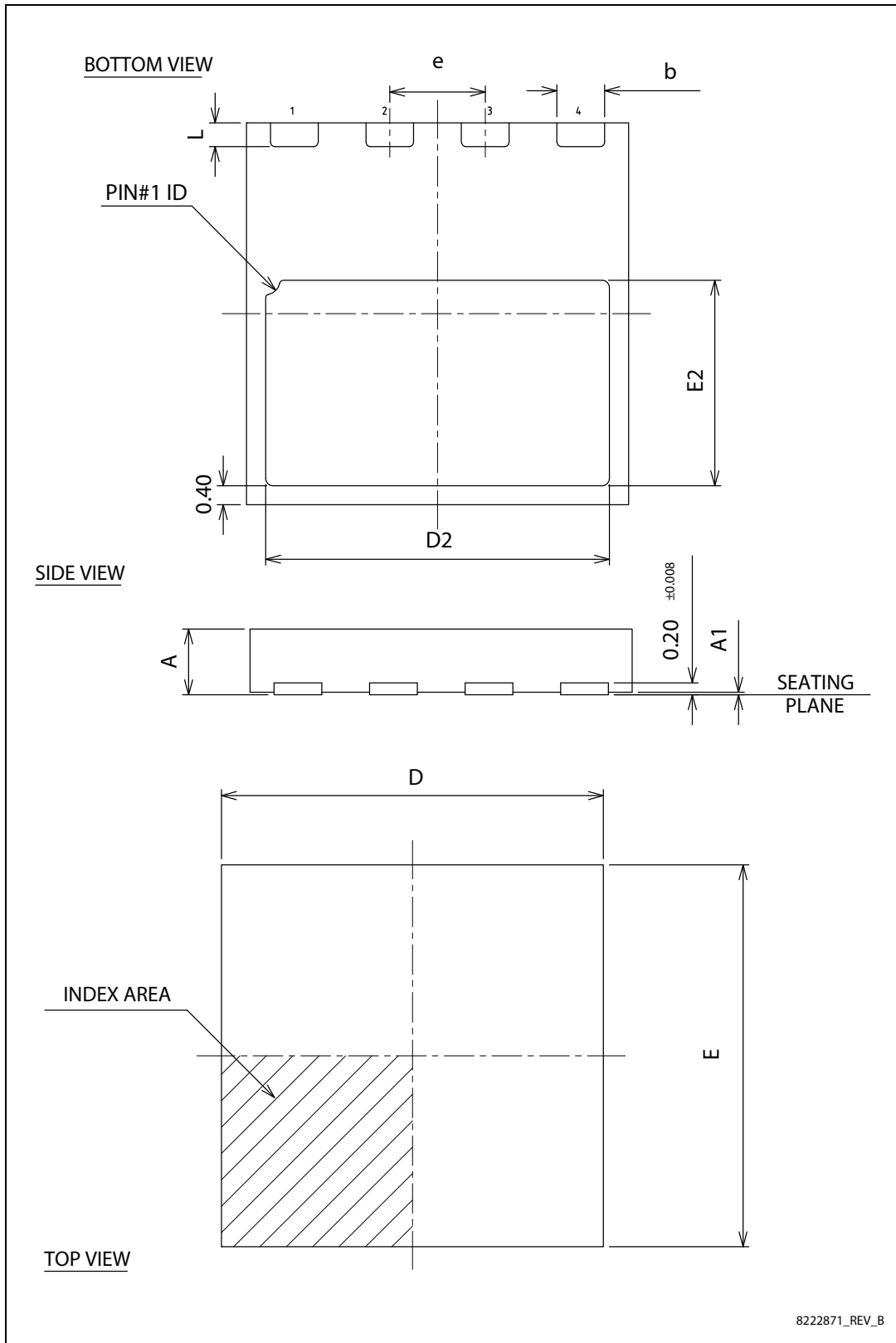
## 4 Package mechanical data

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.

Table 8. PowerFLAT™ 8x8 HV mechanical data

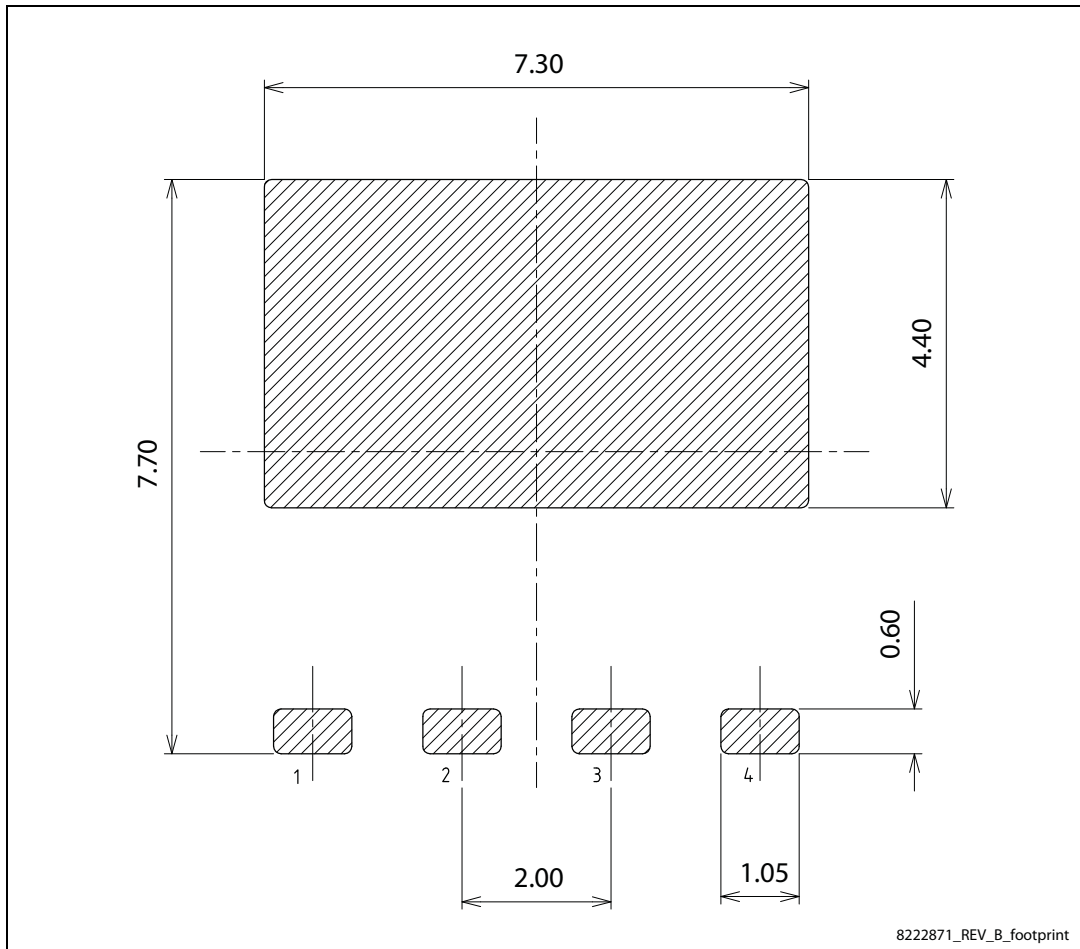
Dim.	mm		
	Min.	Typ.	Max.
A	0.80	0.90	1.00
A1	0.00	0.02	0.05
b	0.95	1.00	1.05
D		8.00	
E		8.00	
D2	7.05	7.20	7.30
E2	4.15	4.30	4.40
e		2.00	
L	0.40	0.50	0.60

Figure 21. PowerFLAT™ 8x8 HV drawing mechanical data



8222871\_REV\_B

Figure 22. PowerFLAT™ 8x8 HV recommended footprint (dimension in millimeters)



# 5 Packaging mechanical data

Figure 23. PowerFLAT™ 8x8 HV tape (dimension in millimeters)

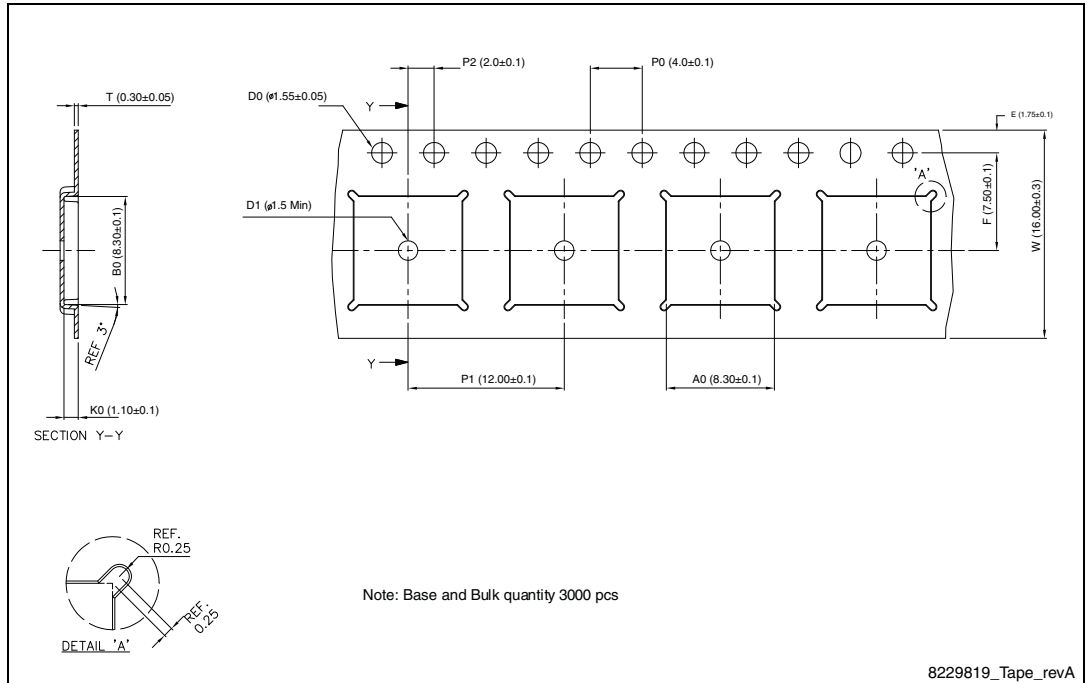
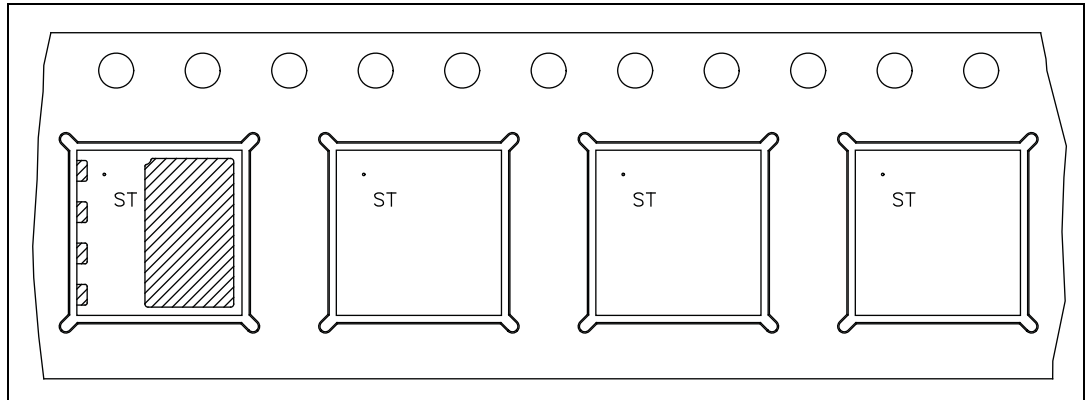


Figure 24. PowerFLAT™ 8x8 HV package orientation in carrier tape





## 6 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
17-Jul-2013	1	First release



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