

N-channel 550 V, 0.066 Ω typ., 22.5 A MDmesh™ M5 Power MOSFET in a PowerFLAT™ 8x8 HV package

Datasheet — production data

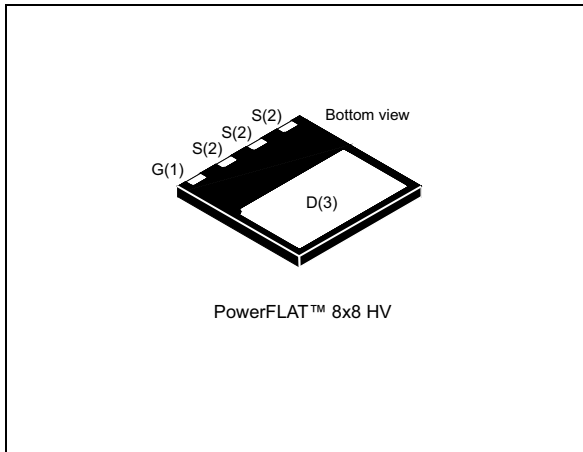
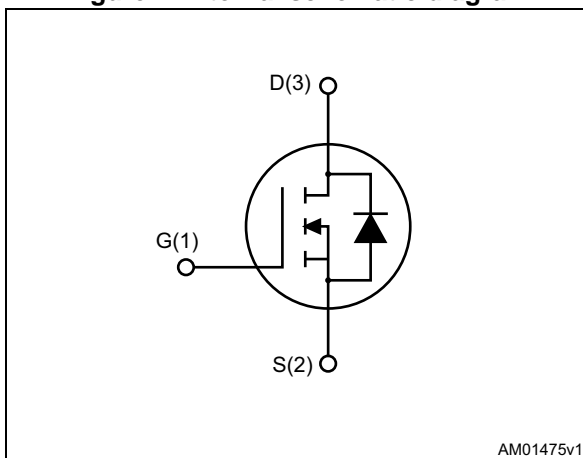


Figure 1. Internal schematic diagram



Features

Order code	$V_{DS} @ T_{Jmax}$	$R_{DS(on) max}$	I_D
STL36N55M5	600 V	0.090 Ω	22.5 A

- Extremely low $R_{DS(on)}$
- Low gate charge and input capacitance
- Excellent switching performance
- 100% avalanche tested

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET based on MDmesh™ M5 innovative vertical process technology combined with the well-known PowerMESH™ horizontal layout. The resulting product offers extremely low on-resistance, making it particularly suitable for applications requiring high power and superior efficiency.

Table 1. Device summary

Order code	Marking	Package	Packaging
STL36N55M5	36N55M5	PowerFLAT™ 8x8 HV	Tape and reel

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	550	V
V_{GS}	Gate-source voltage	± 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 $T_C = 100\text{ }^\circ\text{C}$	17	A
$I_{DM}^{(1),(2)}$	Drain current (pulsed)	90	A
$I_D^{(3)}$	Drain current (continuous) at $T_{amb} = 25\text{ }^\circ\text{C}$	3.7	A
$I_D^{(3)}$	Drain current (continuous) at $T_{amb} = 100\text{ }^\circ\text{C}$	2.2	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 $T_{j\max}$)	7	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 inch², 2 oz Cu.
4. $I_{SD} \leq 22.5\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{Peak} < V_{(BR)DSS}$, $V_{DD} = 340\text{ V}$

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 inch², 2 oz 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	$I_D = 1\text{ mA}, V_{GS} = 0$	550			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 550\text{ V}$			1	μA
		$V_{DS} = 550\text{ V}, T_C = 125\text{ °C}$			100	μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 25\text{ V}$			± 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	$V_{GS} = 10\text{ V}, I_D = 16.5\text{ A}$		0.066	0.090	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100\text{ V}, f = 1\text{ MHz}, V_{GS} = 0$	-	2670	-	pF
C_{oss}	Output capacitance		-	75	-	pF
C_{rss}	Reverse transfer capacitance		-	6.6	-	pF
$C_{o(er)}^{(1)}$	Equivalent output capacitance energy related	$V_{GS} = 0, V_{DS} = 0\text{ to }440\text{ V}$	-	71	-	pF
$C_{o(tr)}^{(2)}$	Equivalent output capacitance time related		-	192	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz open drain}$	-	1.85	-	Ω
Q_g	Total gate charge	$V_{DD} = 440\text{ V}, I_D = 16.5\text{ A}, V_{GS} = 10\text{ V}$ (see Figure 16)	-	62	-	nC
Q_{gs}	Gate-source charge		-	15	-	nC
Q_{gd}	Gate-drain charge		-	27	-	nC

- $C_{o(er)}$ 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}
- $C_{o(tr)}$ 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	$V_{DD} = 400\text{ V}$, $I_D = 22\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 20)	-	56	-	ns
$t_{r(V)}$	Voltage rise time		-	13	-	ns
$t_{f(i)}$	Current fall time		-	13	-	ns
$t_{c(off)}$	Crossing time		-	17	-	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 Figure 17)	-	292		ns
Q_{rr}	Reverse recovery charge		-	4.2		μC
I_{RRM}	Reverse recovery current		-	29		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 Figure 17)	-	364		ns
Q_{rr}	Reverse recovery charge		-	6		μC
I_{RRM}	Reverse recovery current		-	33		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 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

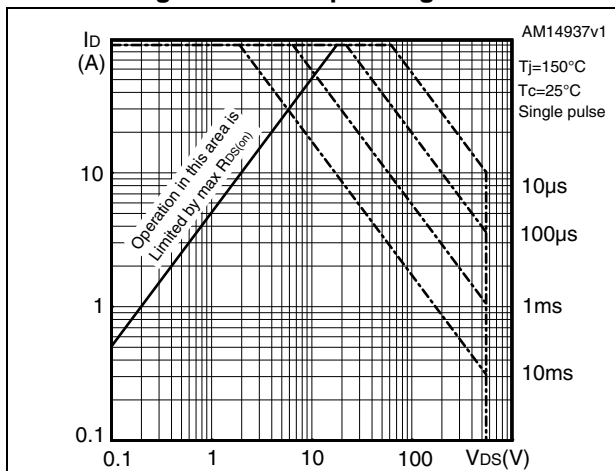


Figure 3. Thermal impedance

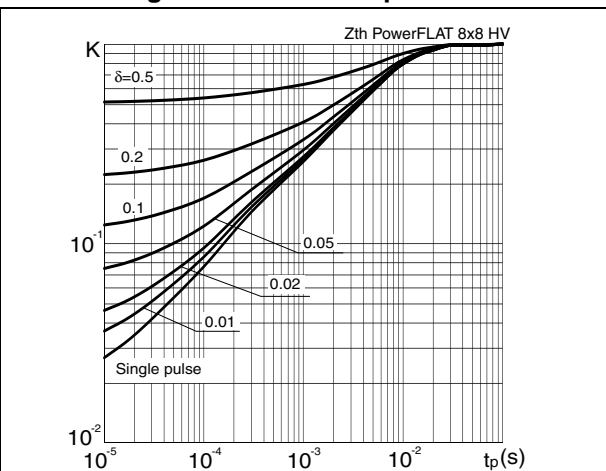


Figure 4. Output characteristics

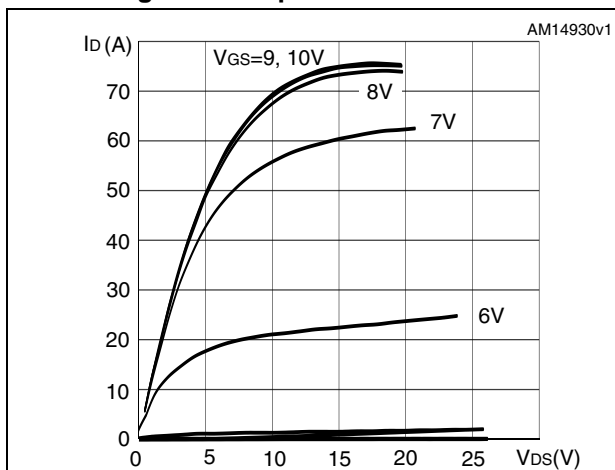


Figure 5. Transfer characteristics

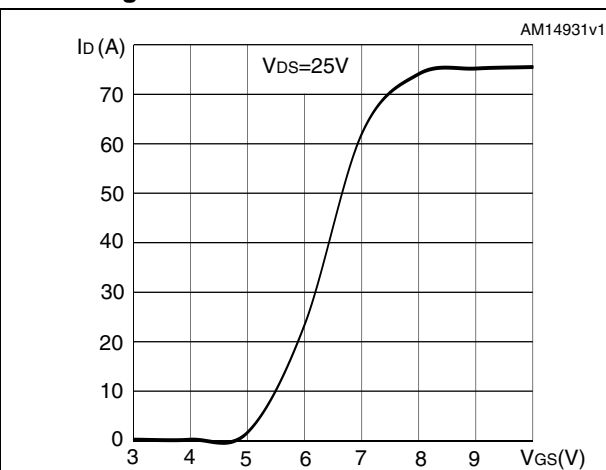


Figure 6. Gate charge vs gate-source voltage

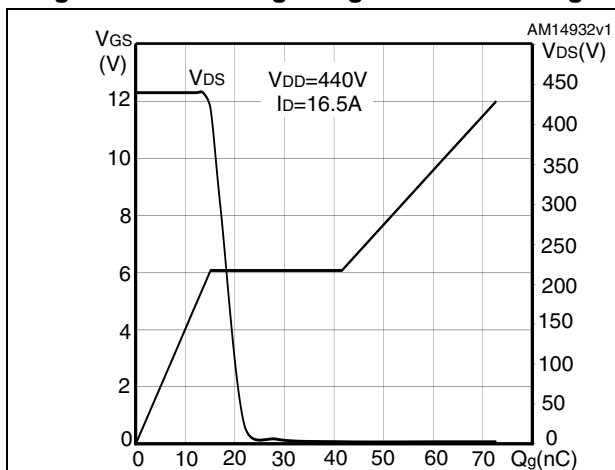


Figure 7. Static drain-source on-resistance

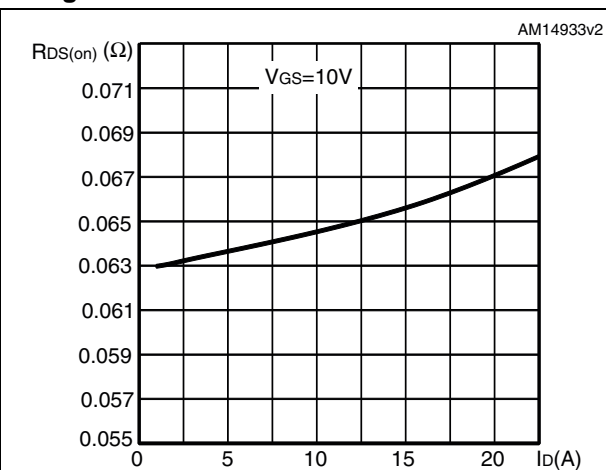


Figure 8. Capacitance variations

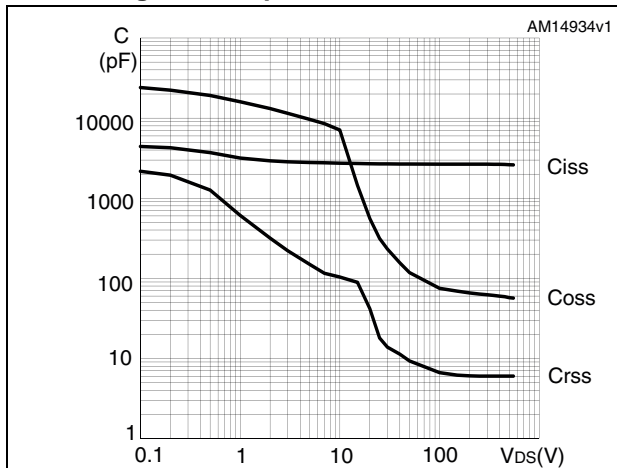


Figure 9. Output capacitance stored energy

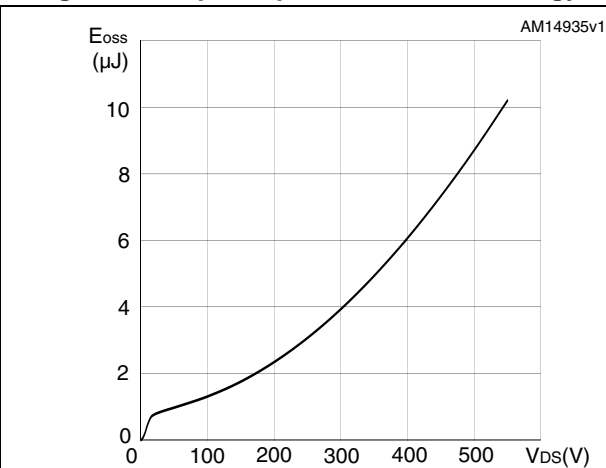


Figure 10. Normalized gate threshold voltage vs temperature

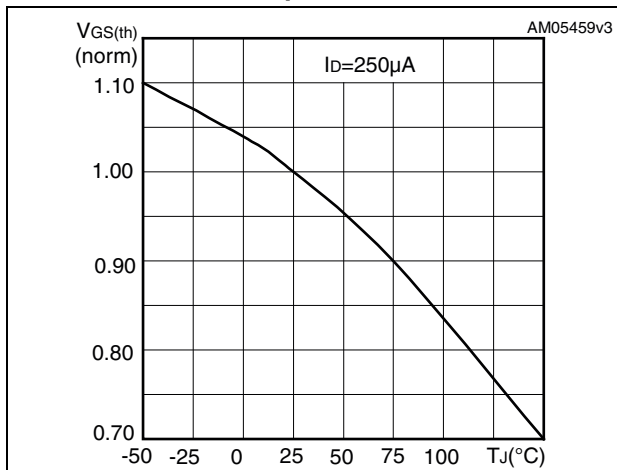


Figure 11. Normalized on-resistance vs temperature

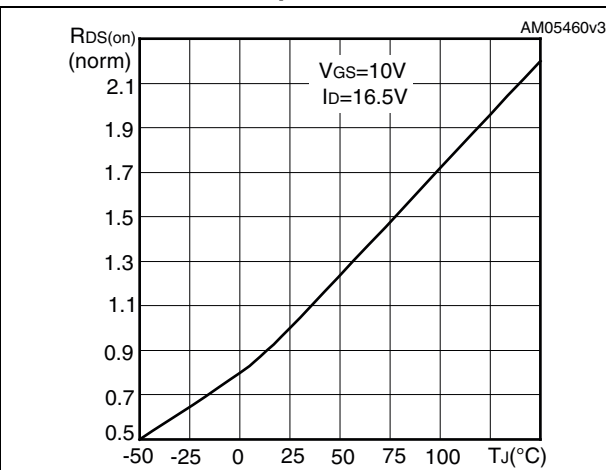


Figure 12. Source-drain diode forward characteristics

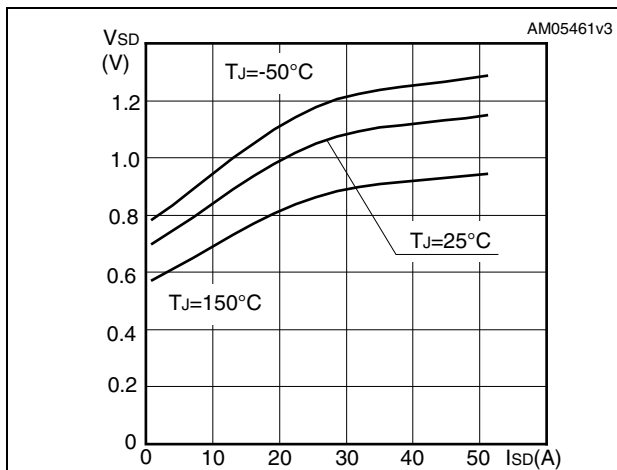


Figure 13. Normalized V(BR)DSS vs temperature

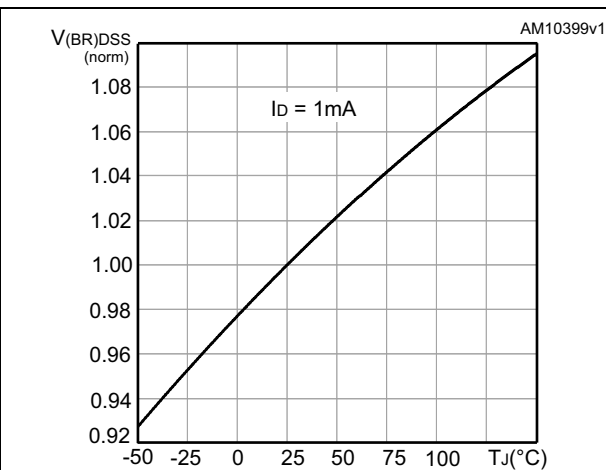
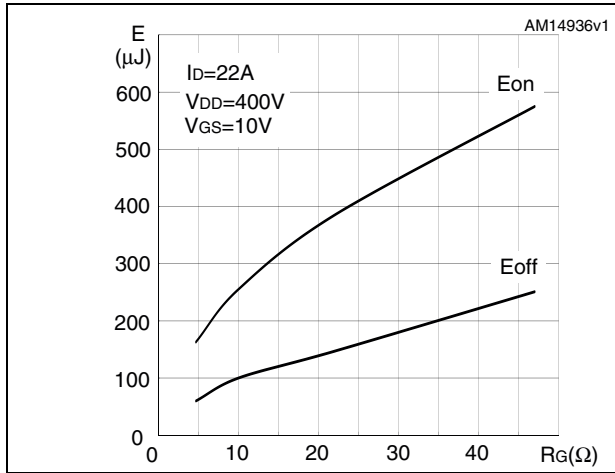


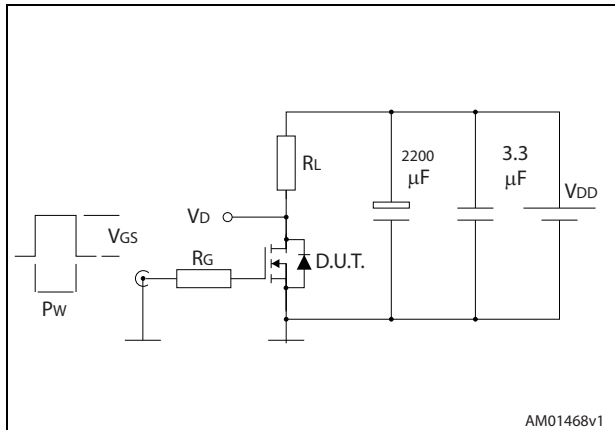
Figure 14. Switching losses vs gate resistance
(1)



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

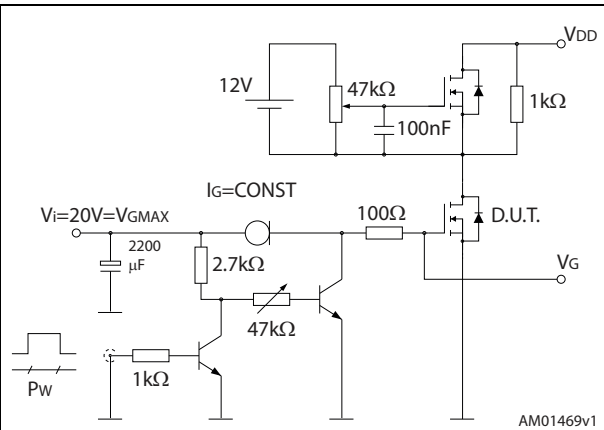
3 Test circuits

Figure 15. Switching times test circuit for resistive load



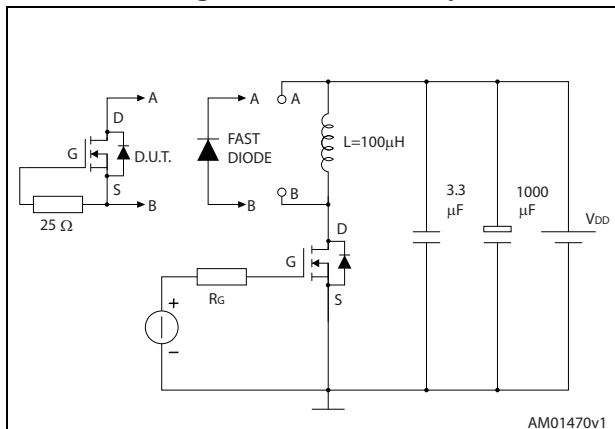
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Figure 16. Gate charge test circuit



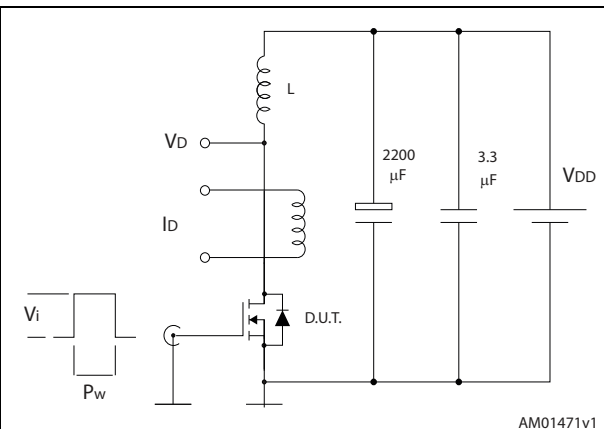
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Figure 17. Test circuit for inductive load switching and diode recovery times



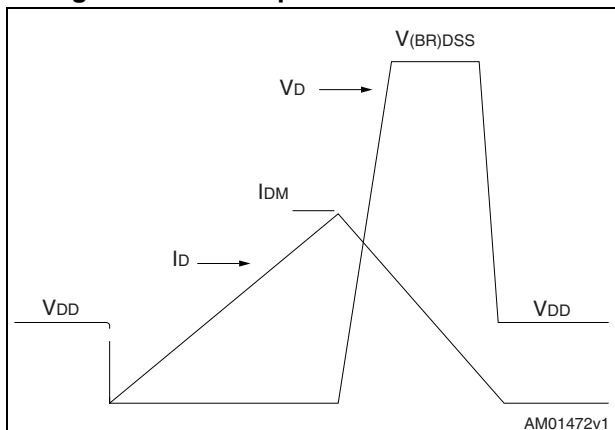
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Figure 18. Unclamped inductive load test circuit



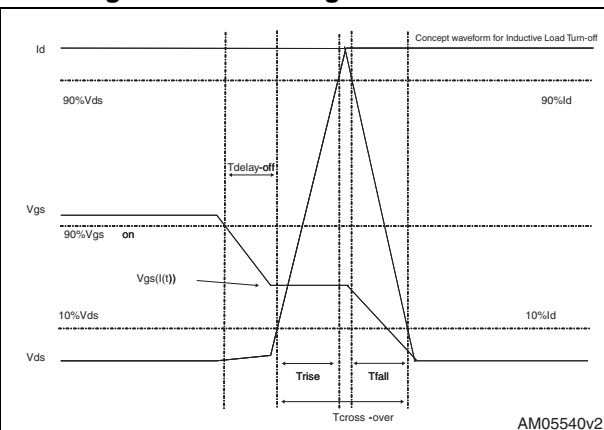
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Figure 19. Unclamped inductive waveform



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[®] 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 21. PowerFLAT™ 8x8 HV drawing mechanical data

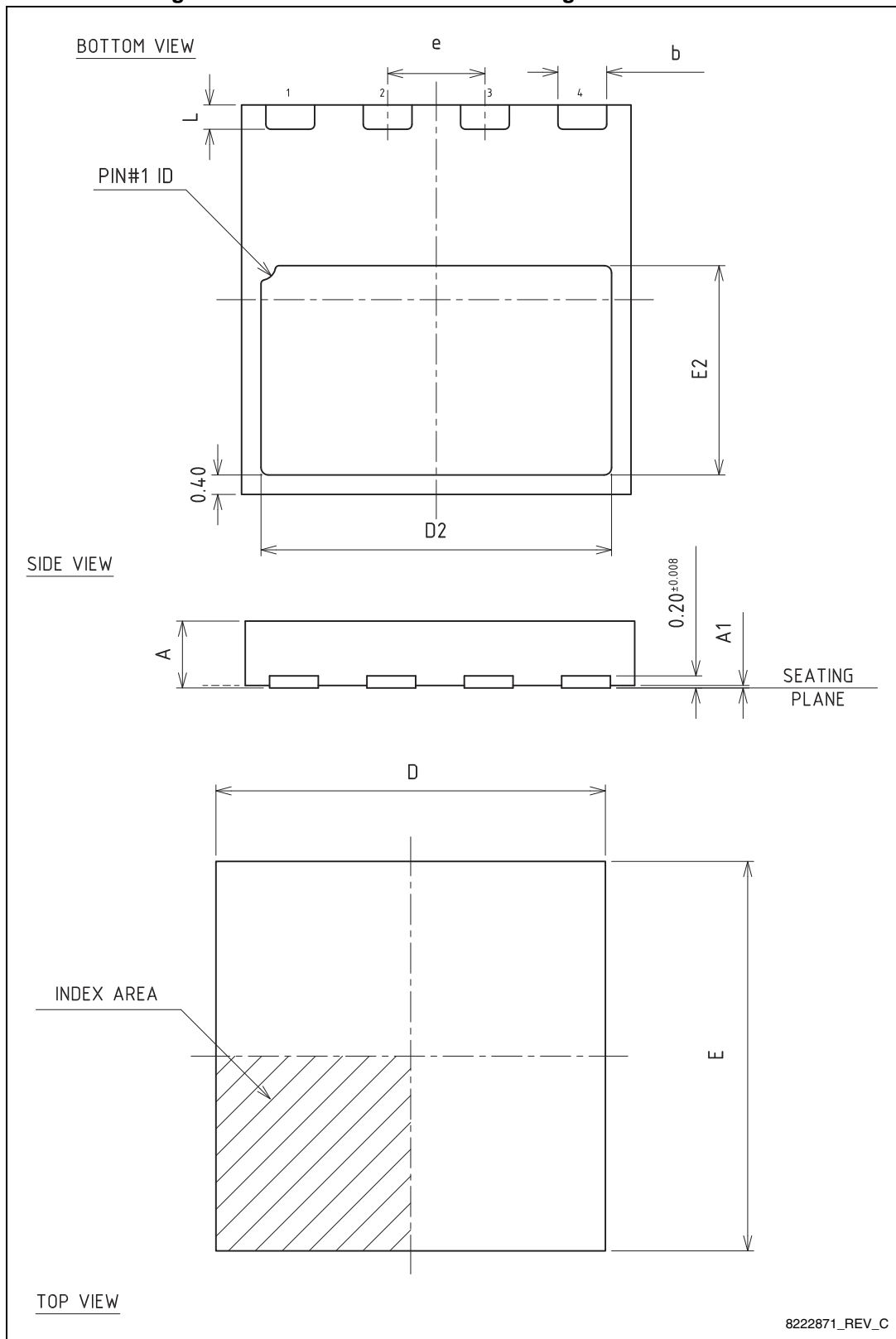
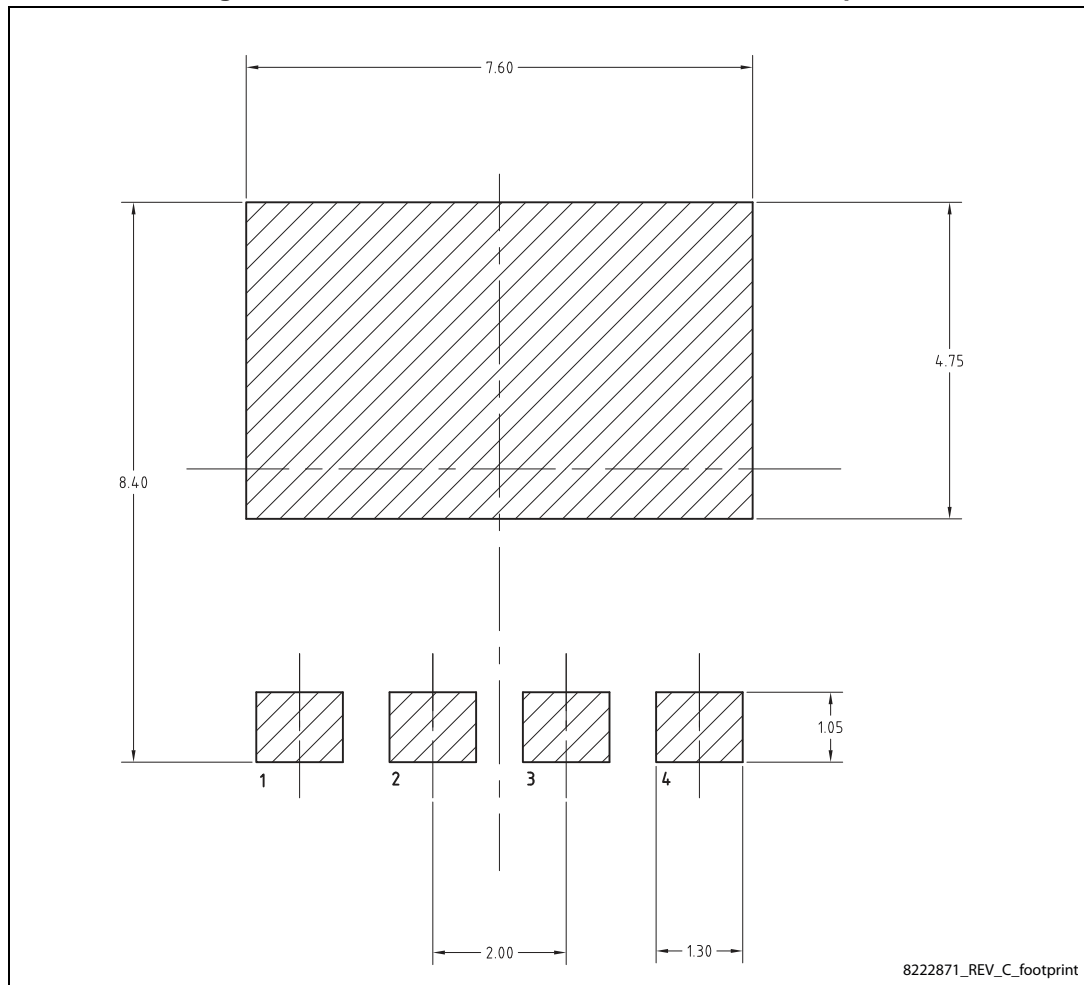


Table 8. PowerFLAT™ 8x8 HV mechanical data

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 22. PowerFLAT™ 8x8 HV recommended footprint



8222871_REV_C_footprint

5 Packaging mechanical data

Figure 23. PowerFLAT™ 8x8 HV tape

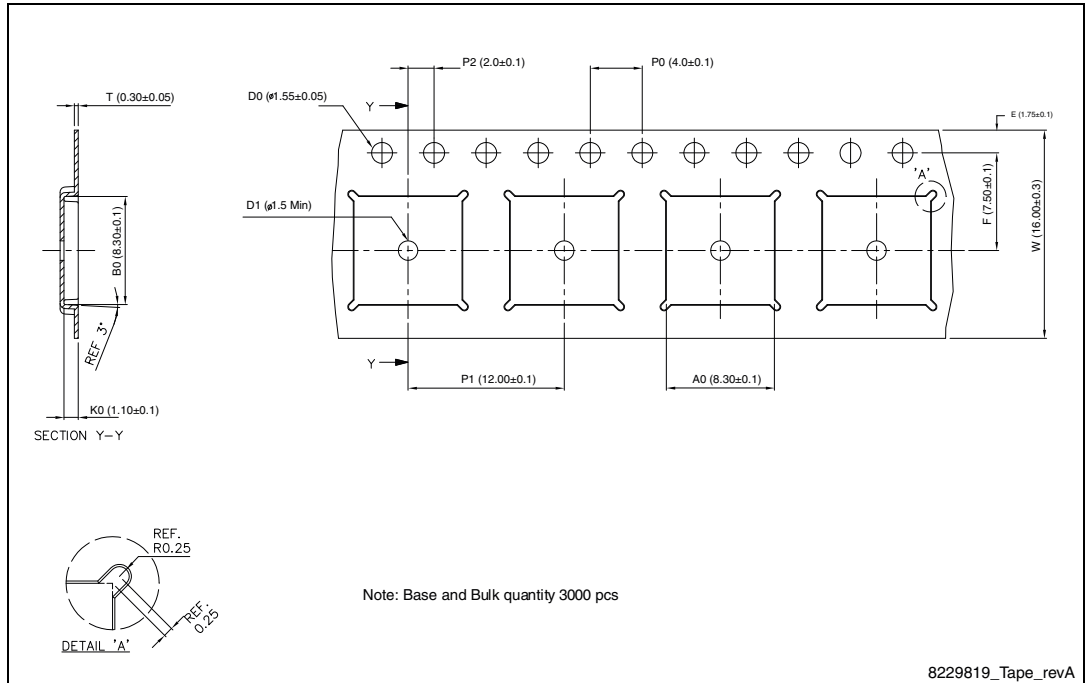


Figure 24. PowerFLAT™ 8x8 HV package orientation in carrier tape.

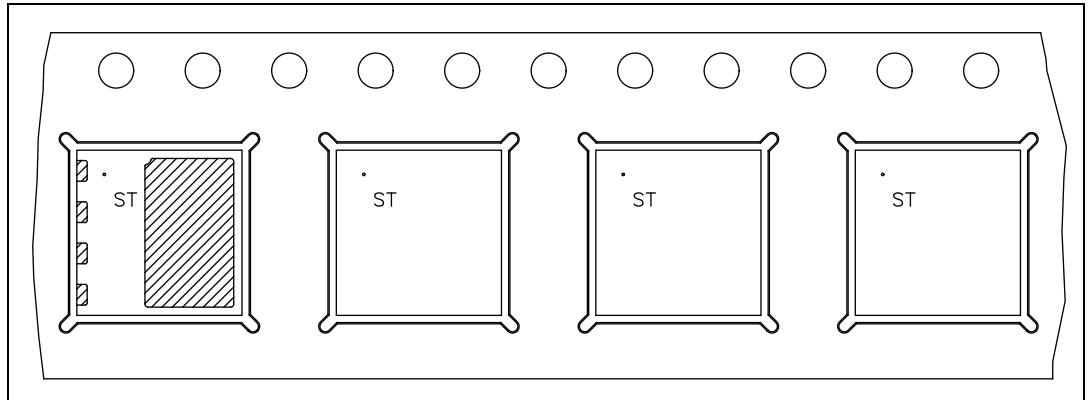
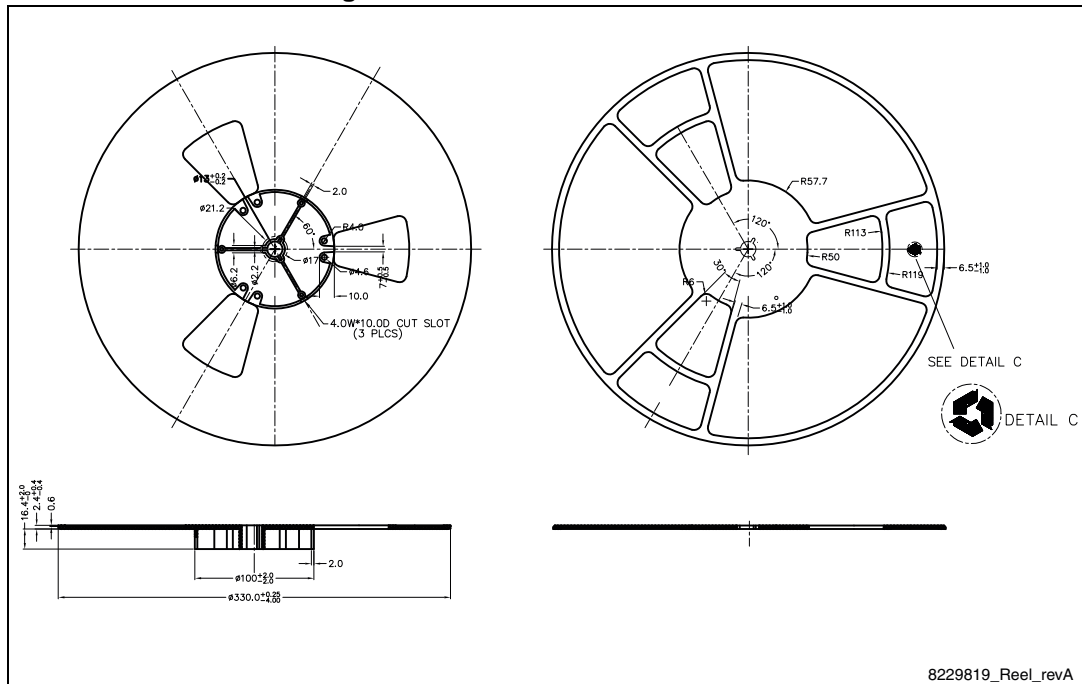


Figure 25. PowerFLAT™ 8x8 HV reel



6 Revision history

Table 9. Document revision history

Date	Revision	Changes
14-Dec-2011	1	First release.
17-Oct-2012	2	Updated: Table 5, 6 and Table 7.: <i>Source drain diode</i> typ. values
24-Jan-2013	3	<ul style="list-style-type: none">– Modified: Figure 1: Internal schematic diagram 4 and 6– Document status promoted from preliminary data to production data– Modified: V_{DD} on Table 5– Minor text changes
22-Sep-2014	4	<ul style="list-style-type: none">– Updated title, features and description in cover page.– Updated Figure 1: Internal schematic diagram.– Updated Section 4: Package mechanical data.

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