



STL13NM60N

N-channel 600 V, 0.320 Ω , 10 A PowerFLAT™ (8x8) HV
MDmesh™ II Power MOSFET

Features

Order code	$V_{DS} @ T_{Jmax}$	$R_{DS(on) max}$	I_D
STL13NM60N	650 V	< 0.385 Ω	10 A ⁽¹⁾

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

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

Application

Switching applications

Description

This device is a N-channel Power MOSFETs made using the second generation of MDmesh™ technology. This revolutionary transistor associates a new vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

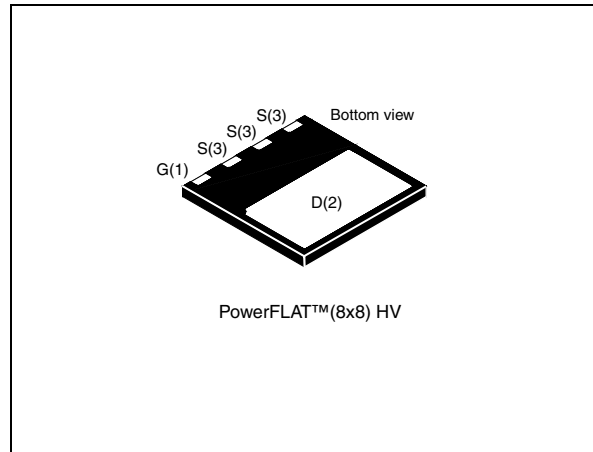


Figure 1. Internal schematic diagram

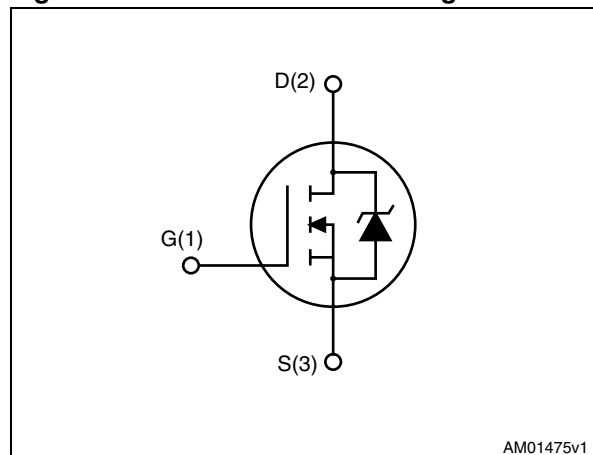


Table 1. Device summary

Order code	Marking	Package	Packaging
STL13NM60N	13NM60N	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 ($V_{GS} = 0$)	600	V
V_{GS}	Gate-source voltage	± 25	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	10	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	6.5	A
$I_D^{(2)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	1.9	A
$I_D^{(2)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	1.1	A
$I_{DM}^{(2),(3)}$	Drain current (pulsed)	7.6	A
$P_{TOT}^{(3)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ (steady state)	3	W
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ (steady state)	90	W
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	3	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	93	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 $R_{thj-case}$
2. Pulse width limited by safe operating area
3. When mounted on FR-4 board of 1 inch^2 , 2oz Cu
4. $I_{SD} \leq 10\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DSpeak} \leq V_{(BR)DSS}$, $V_{DD} = 80\% V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.38	$^\circ\text{C}/\text{W}$
$R_{thj-amb}^{(1)}$	Thermal resistance junction-amb max	45	$^\circ\text{C}/\text{W}$

1. When mounted on 1 inch^2 FR-4 board, 2 oz Cu

2 Electrical characteristics

($T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Table 4. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0$	600			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}$, $T_C = 125\text{ }^{\circ}\text{C}$			1 100	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 25\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 5\text{ A}$		0.320	0.385	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	790 60 3.6	-	pF pF pF
$C_{oss\text{ eq.}}^{(1)}$	Output equivalent capacitance	$V_{DS} = 0\text{ to }480\text{ V}$, $V_{GS} = 0$	-	135	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	4.7	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 480\text{ V}$, $I_D = 10\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 14)	-	30 4 15	-	nC nC nC

1. $C_{oss\text{ eq.}}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DS} .

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	$V_{DD} = 300\text{ V}$, $I_D = 10\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 18)	-	13 25 85 50	-	ns ns ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		10	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		40	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 10\text{ A}$, $V_{GS} = 0$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 10\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ (see Figure 15)	-	340		ns
Q_{rr}	Reverse recovery charge			2		μC
I_{RRM}	Reverse recovery current			18		A
t_{rr}	Reverse recovery time	$I_{SD} = 10\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 15)	-	290		ns
Q_{rr}	Reverse recovery charge			190		μC
I_{RRM}	Reverse recovery current			17		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

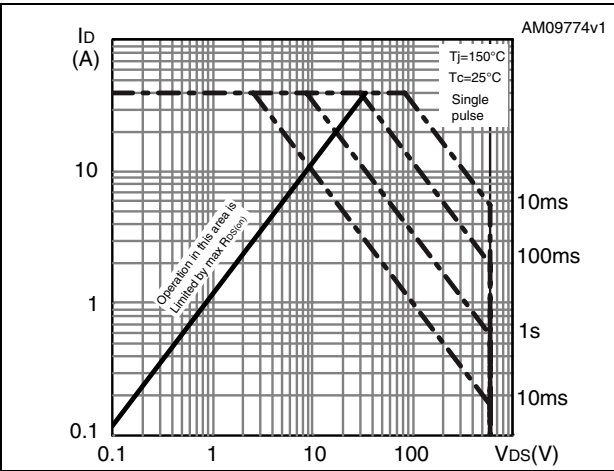


Figure 3. Thermal impedance

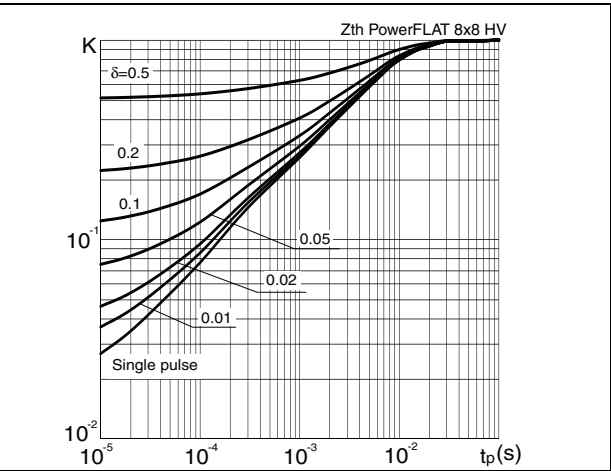


Figure 4. Output characteristics

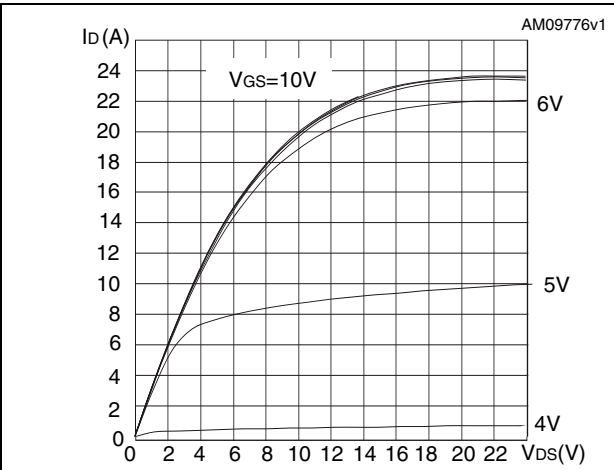


Figure 5. Transfer characteristics

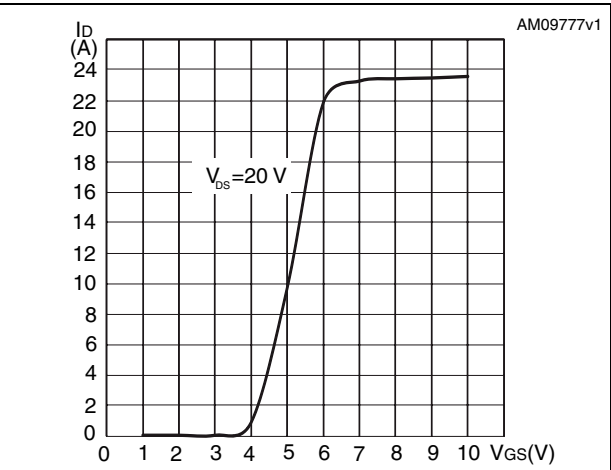


Figure 6. Normalized $B_{V_{DS}}$ vs temperature

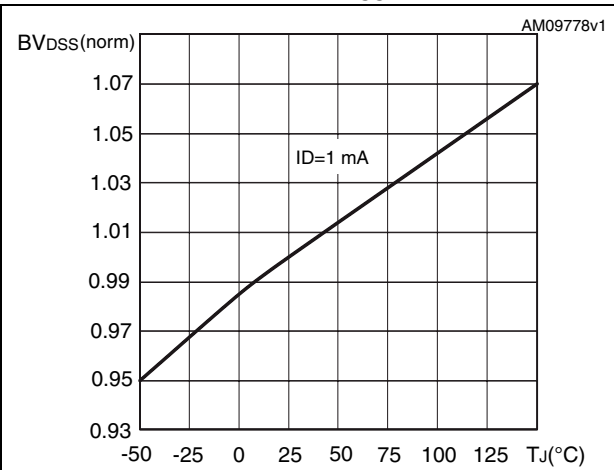


Figure 7. Static drain-source on resistance

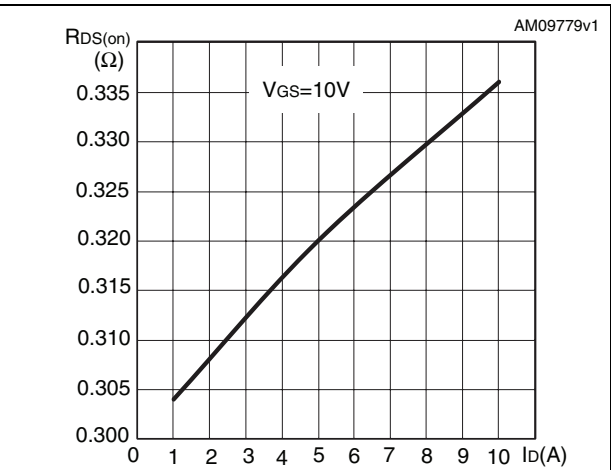


Figure 8. Gate charge vs gate-source voltage

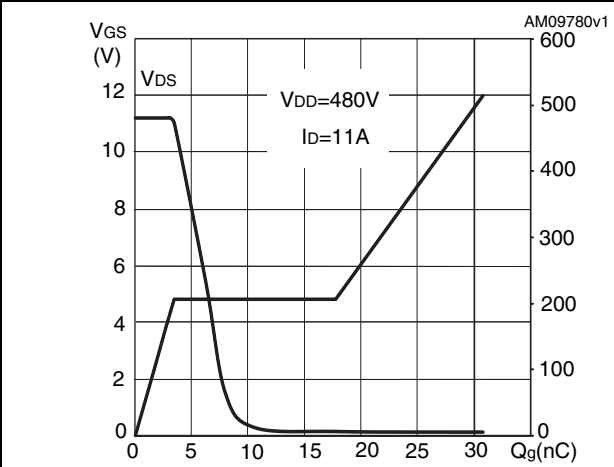


Figure 9. Capacitance variations

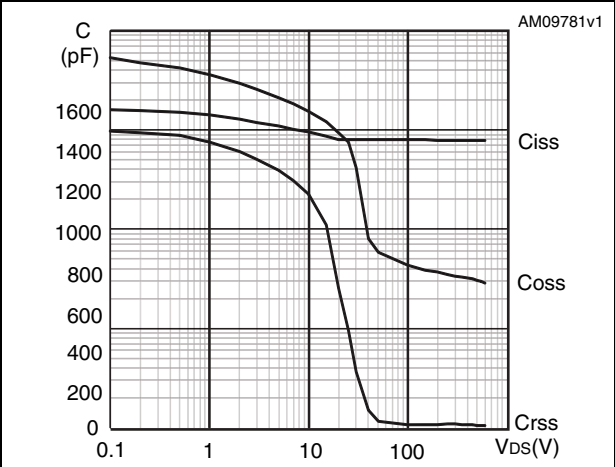


Figure 10. Normalized gate threshold voltage vs temperature

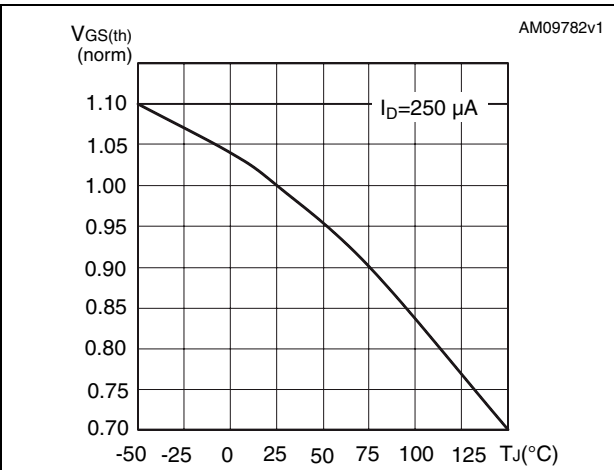


Figure 11. Normalized on resistance vs temperature

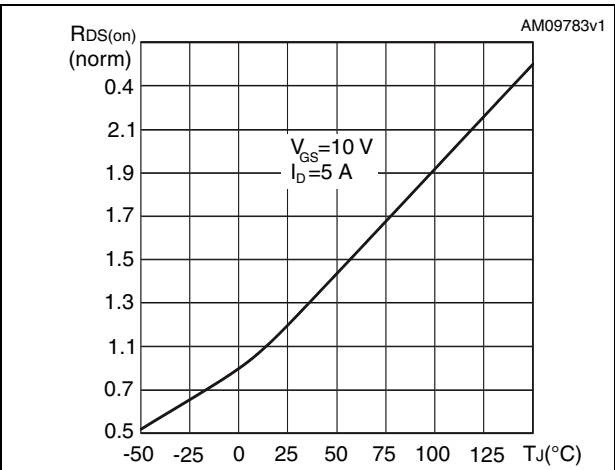
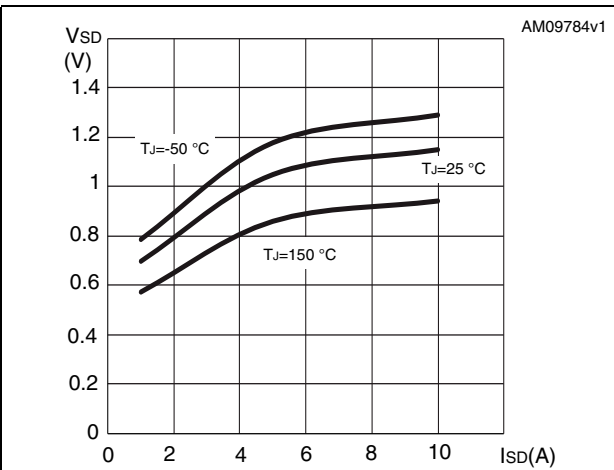


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

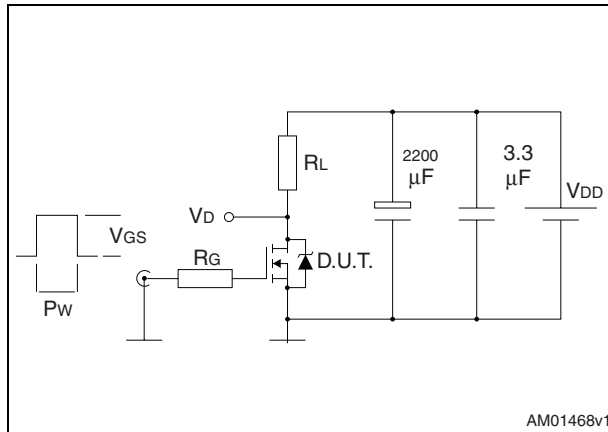


Figure 14. Gate charge test circuit

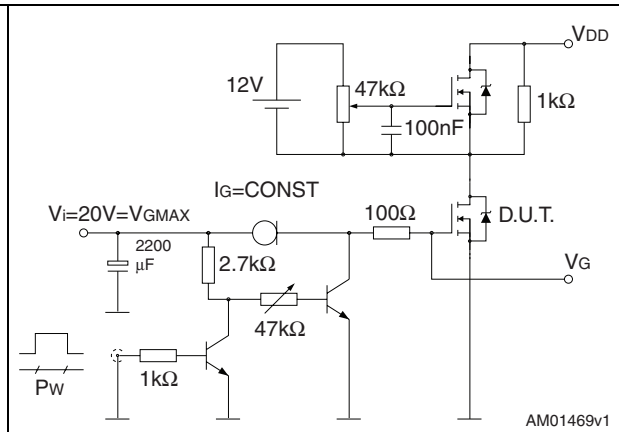


Figure 15. Test circuit for inductive load switching and diode recovery times

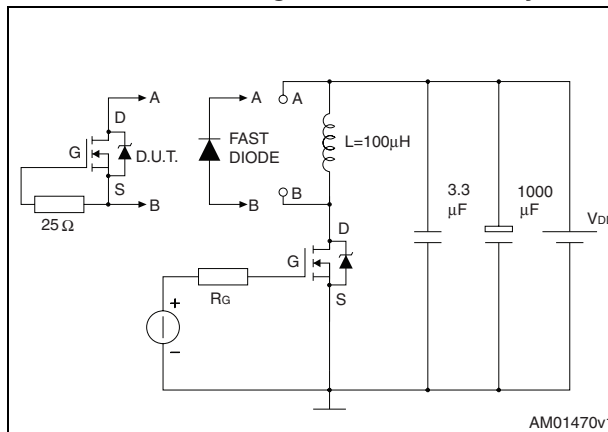


Figure 16. Unclamped inductive load test circuit

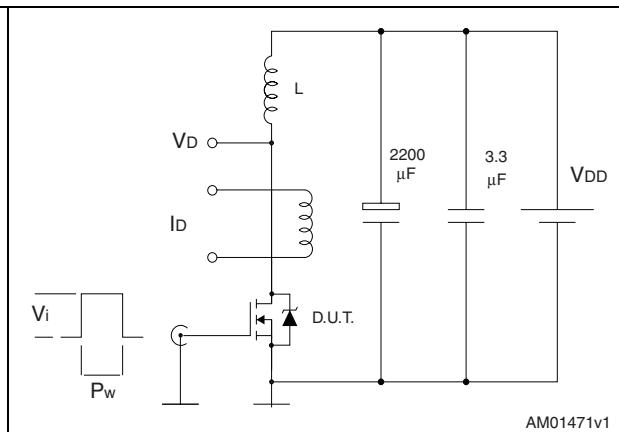


Figure 17. Unclamped inductive waveform

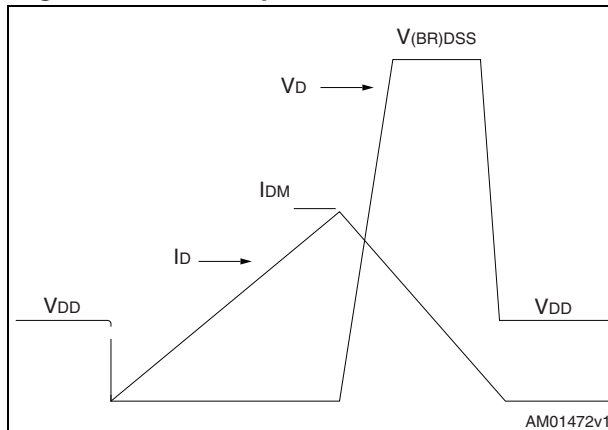
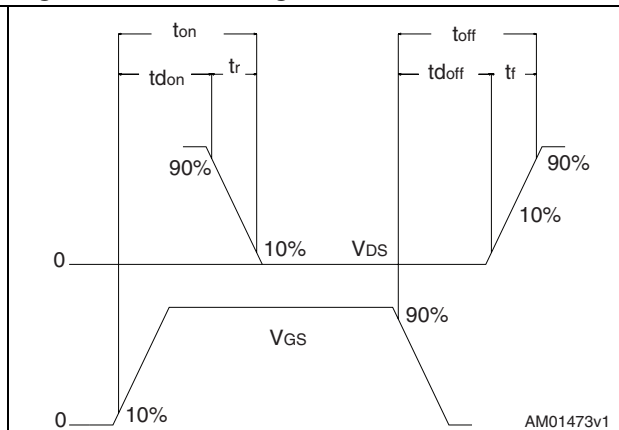


Figure 18. Switching time waveform



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™ 8x8 HV mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80	0.90	1.00
A1		0.02	0.05
b	0.95	1.00	1.05
c		0.10	
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 19. PowerFLAT™ 8x8 HV drawing mechanical data

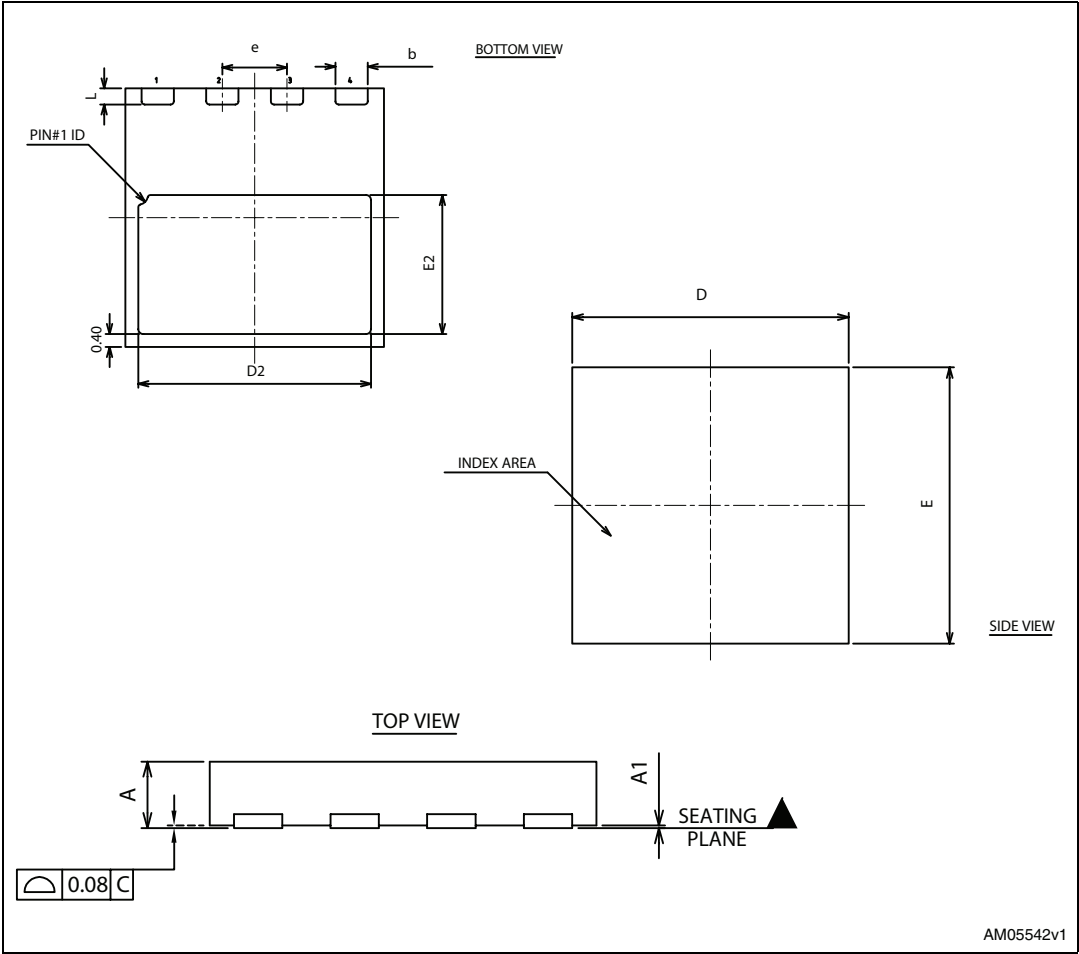
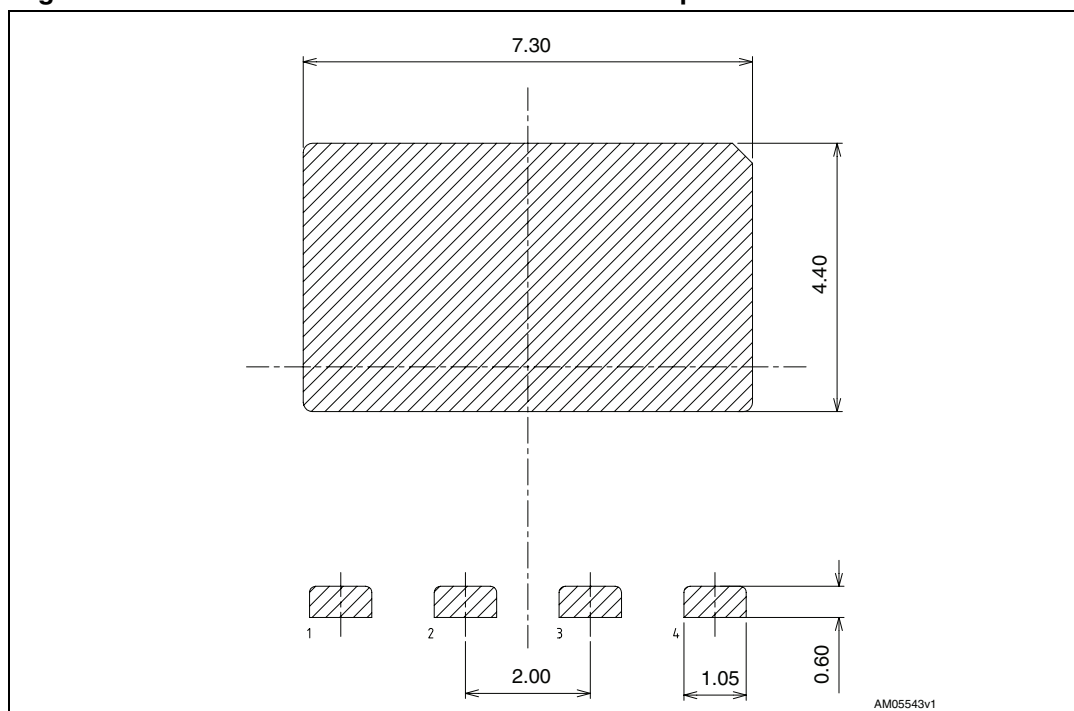


Figure 20. PowerFLAT™ 8x8 HV recommended footprint



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
23-May-2011	1	First release.

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