

N-channel 600 V, 0.26 Ω typ., 12 A MDmesh™ II Power MOSFET in a PowerFLAT™ 8x8 HV package

Datasheet - production data

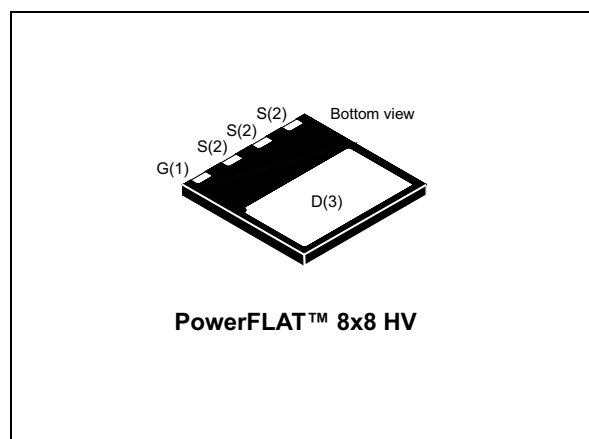
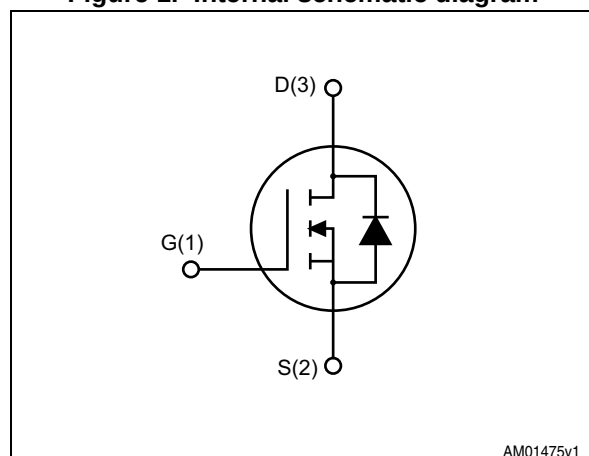


Figure 1. Internal schematic diagram



Features

Order code	$V_{DS} @ T_{Jmax}$	$R_{DS(on)}$ max	I_D
STL18NM60N	650 V	0.310 Ω	12 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

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a 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.

Table 1. Device summary

Order code	Marking	Packages	Packaging
STL18NM60N	18NM60N	PowerFLAT™ 8x8 HV	Tape and reel

Contents

1 **Electrical ratings** 3

2 **Electrical characteristics** 4

 2.1 Electrical characteristics (curves) 6

3 **Test circuits** 8

4 **Package mechanical data** 9

5 **Packaging mechanical data** 13

6 **Revision history** 15



1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	600	V
V_{GS}	Gate-source voltage	± 30	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	12	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	7.5	A
$I_D^{(2)}$	Drain current (continuous) at $T_{amb} = 25\text{ }^{\circ}\text{C}$	2.1	A
$I_D^{(2)}$	Drain current (continuous) at $T_{amb} = 100\text{ }^{\circ}\text{C}$	1.2	A
$I_{DM}^{(2),(3)}$	Drain current (pulsed)	8.4	A
$P_{TOT}^{(2)}$	Total dissipation at $T_{amb} = 25\text{ }^{\circ}\text{C}$	3	W
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	110	W
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	4.5	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	350	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. When mounted on 1inch² FR-4 board, 2 oz Cu
3. Pulse width limited by safe operating area
4. $I_{SD} \leq 12\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DSpeak} \leq V_{(BR)DSS}$, $V_{DD} = 80\% V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.14	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}^{(1)}$	Thermal resistance junction-amb max	42	$^{\circ}\text{C}/\text{W}$

1. When mounted on 1inch² 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 ($V_{GS} = 0$)	$V_{DS} = 600\text{ V}$			1	μA
		$V_{DS} = 600\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}$			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	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 6\text{ A}$		0.260	0.310	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	1000	-	pF
C_{oss}	Output capacitance			60	-	pF
C_{rss}	Reverse transfer capacitance			3	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Output equivalent capacitance	$V_{DS} = 0\text{ to }480\text{ V}$, $V_{GS} = 0$	-	225	-	pF
R_G	Intrinsic gate resistance	$f = 1$, $I_D = 0$	-	3.5	-	Ω
Q_g	Total gate charge	$V_{DD} = 480\text{ V}$, $I_D = 12\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 14)	-	35	-	nC
Q_{gs}	Gate-source charge		-	6	-	nC
Q_{gd}	Gate-drain charge		-	20	-	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
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$, $I_D = 6.5\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 17)	-	12	-	ns
t_r	Rise time			15		ns
$t_{d(off)}$	Turn-on delay time			55		ns
t_f	Fall time			25		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		12	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		48	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 12\text{ A}$, $V_{GS} = 0$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 12\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$ (see Figure 15)	-	300		ns
Q_{rr}	Reverse recovery charge		-	4.0		μC
I_{RRM}	Reverse recovery current		-	25		A
t_{rr}	Reverse recovery time	$V_{DD} = 60\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$, $I_{SD} = 12\text{ A}$ $T_j = 150\text{ }^\circ\text{C}$ (see Figure 15)	-	360		ns
Q_{rr}	Reverse recovery charge		-	4.5		μC
I_{RRM}	Reverse recovery current		-	25		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

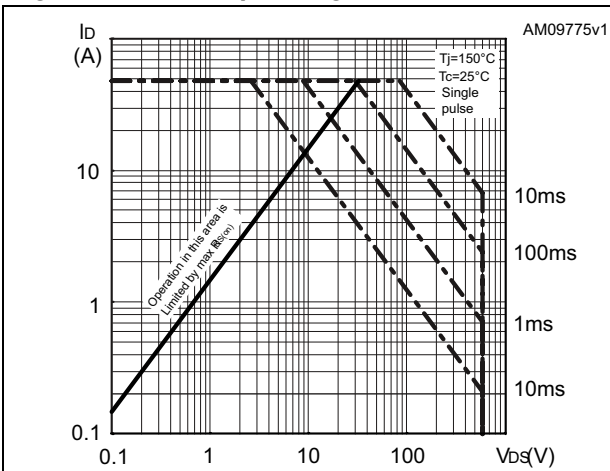


Figure 3. Thermal impedance

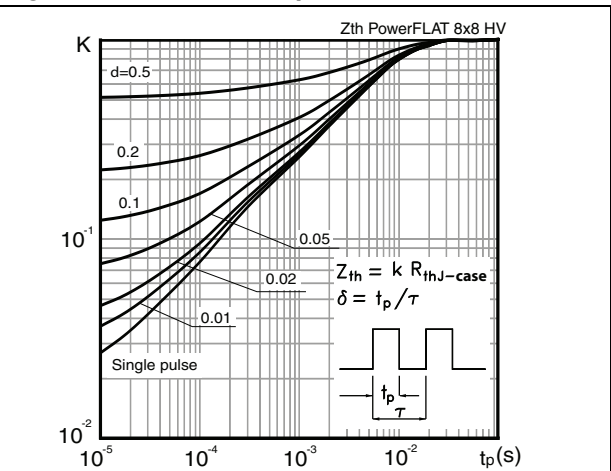


Figure 4. Output characteristics

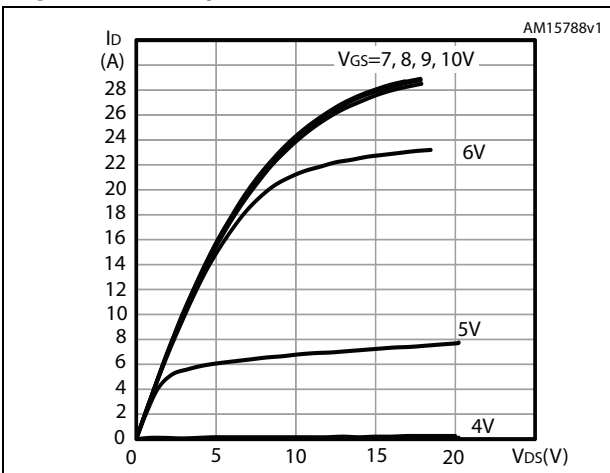


Figure 5. Transfer characteristics

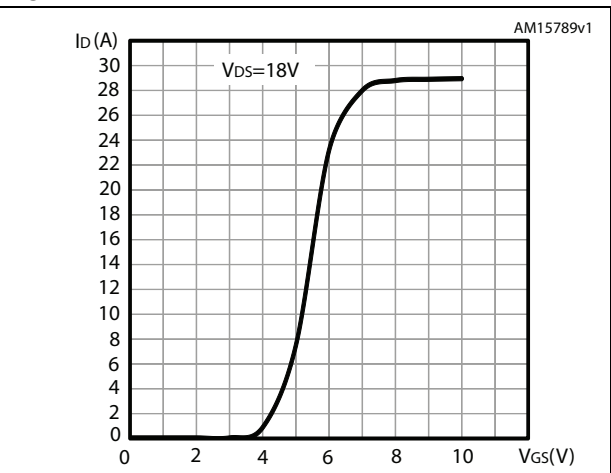


Figure 6. Normalized V_{DS} vs temperature

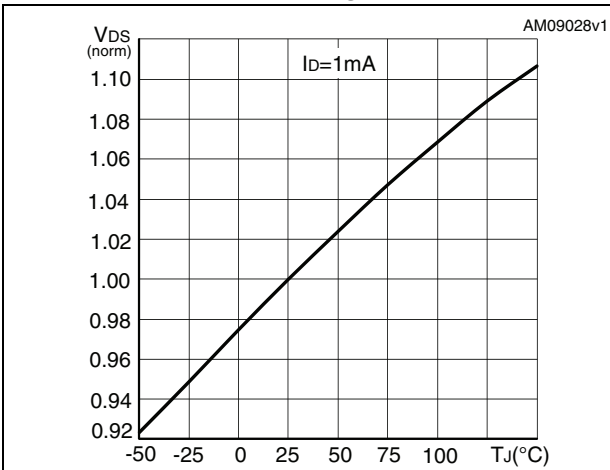


Figure 7. Static drain-source on-resistance

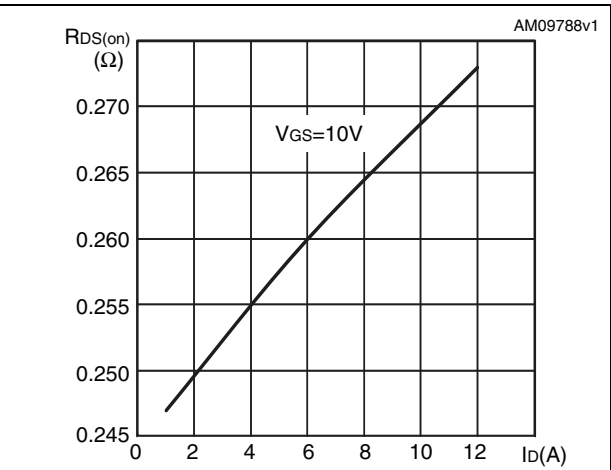


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

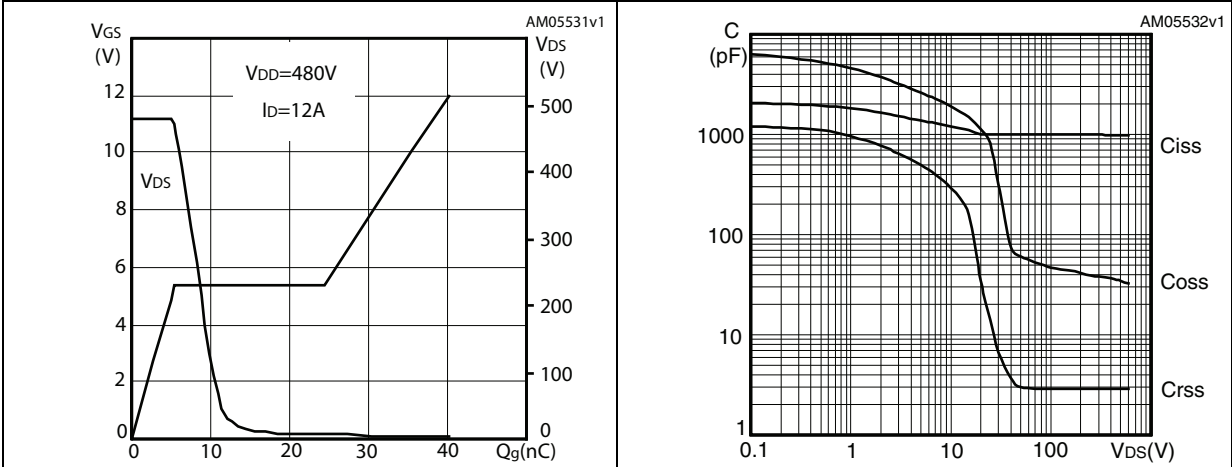


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on-resistance vs temperature

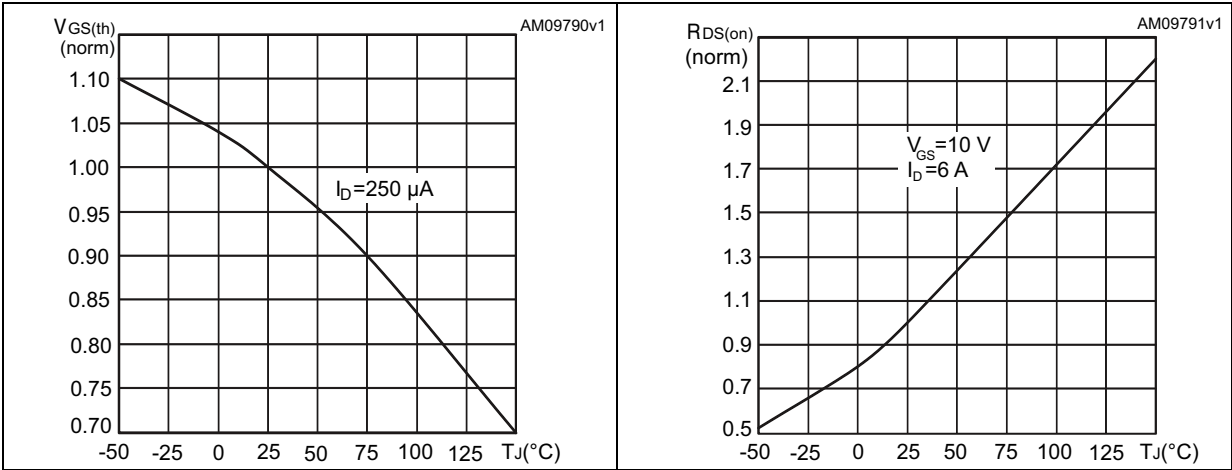
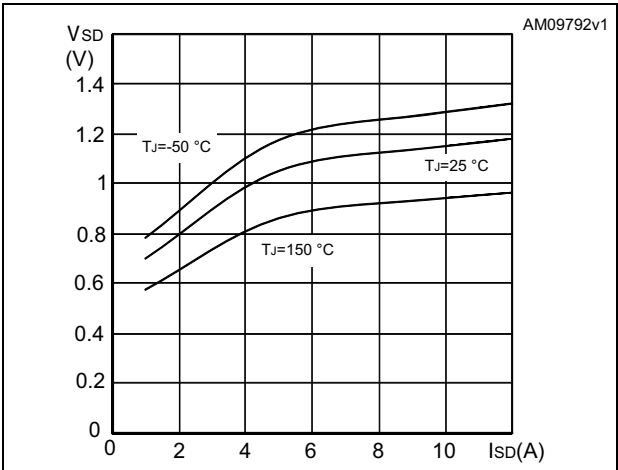


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

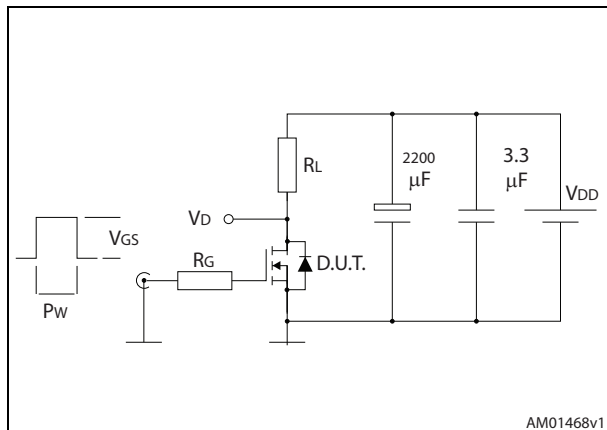


Figure 14. Gate charge test circuit

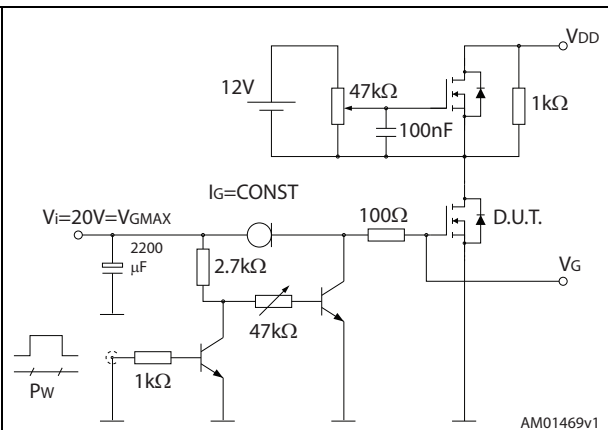


Figure 15. Test circuit for inductive load switching and diode recovery times

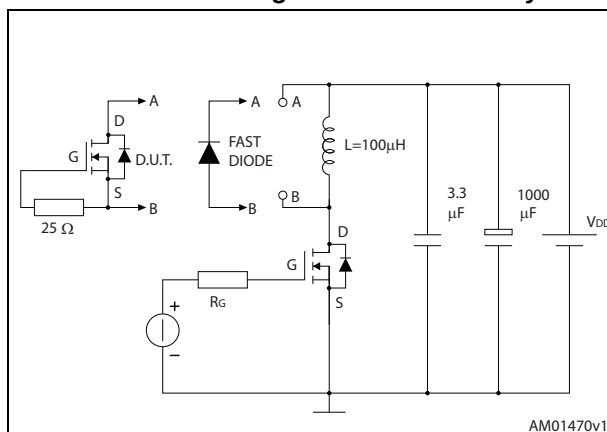


Figure 16. Unclamped inductive load test circuit

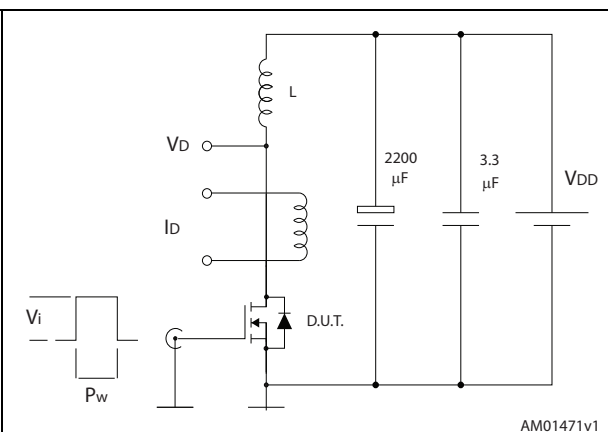


Figure 17. Unclamped inductive waveform

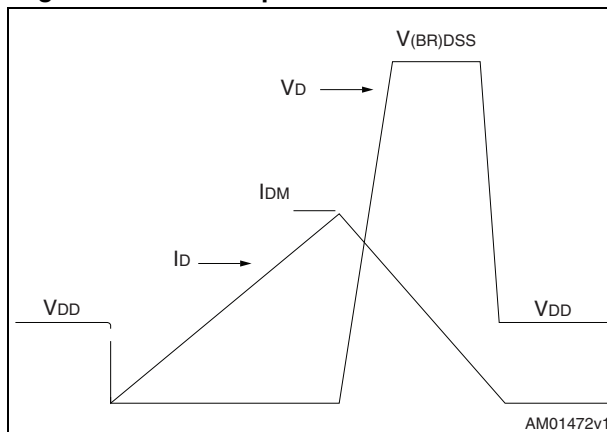
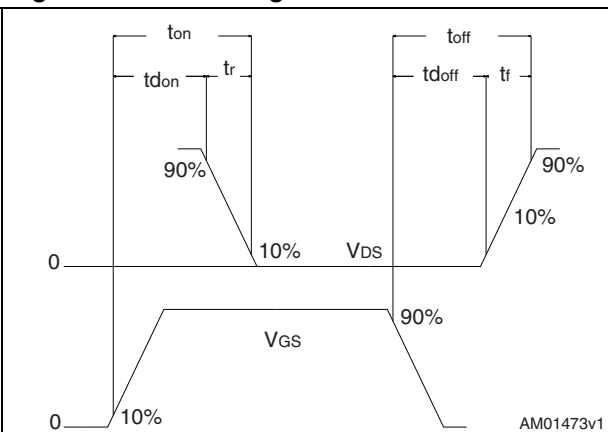


Figure 18. Switching time waveform



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	0.00	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 19. PowerFLAT™ 8x8 HV drawing mechanical data

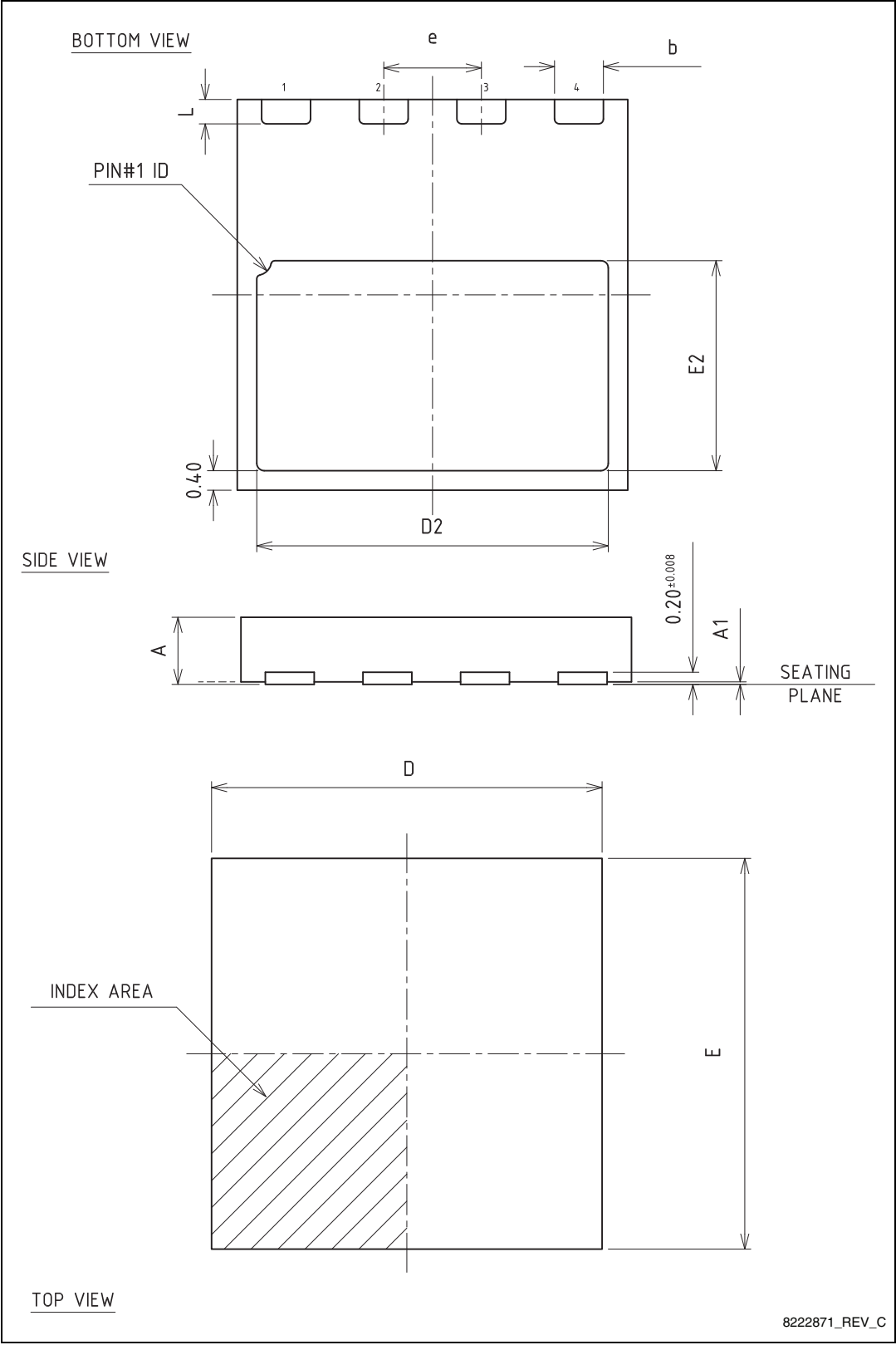
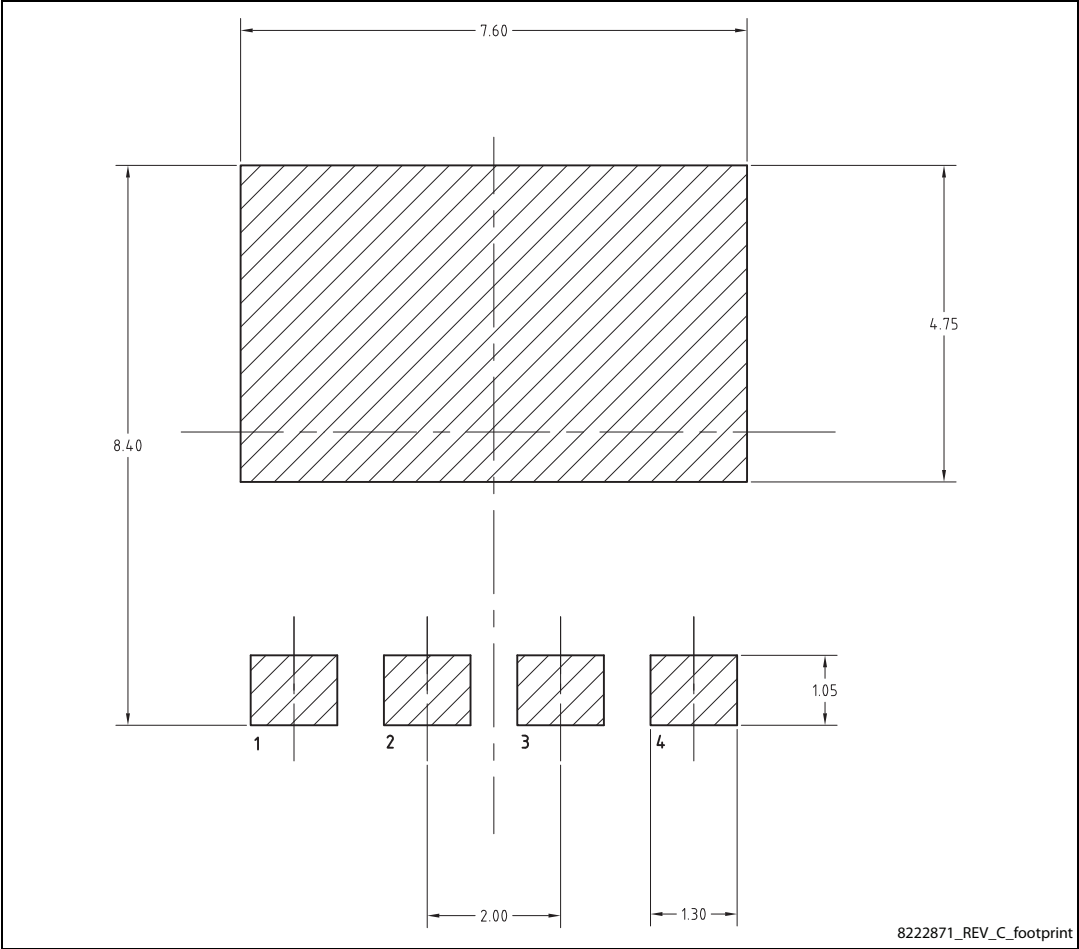


Figure 20. PowerFLAT™ 8x8 HV recommended footprint (dimensions in mm.)



5 Packaging mechanical data

Figure 21. PowerFLAT™ 8x8 HV tape

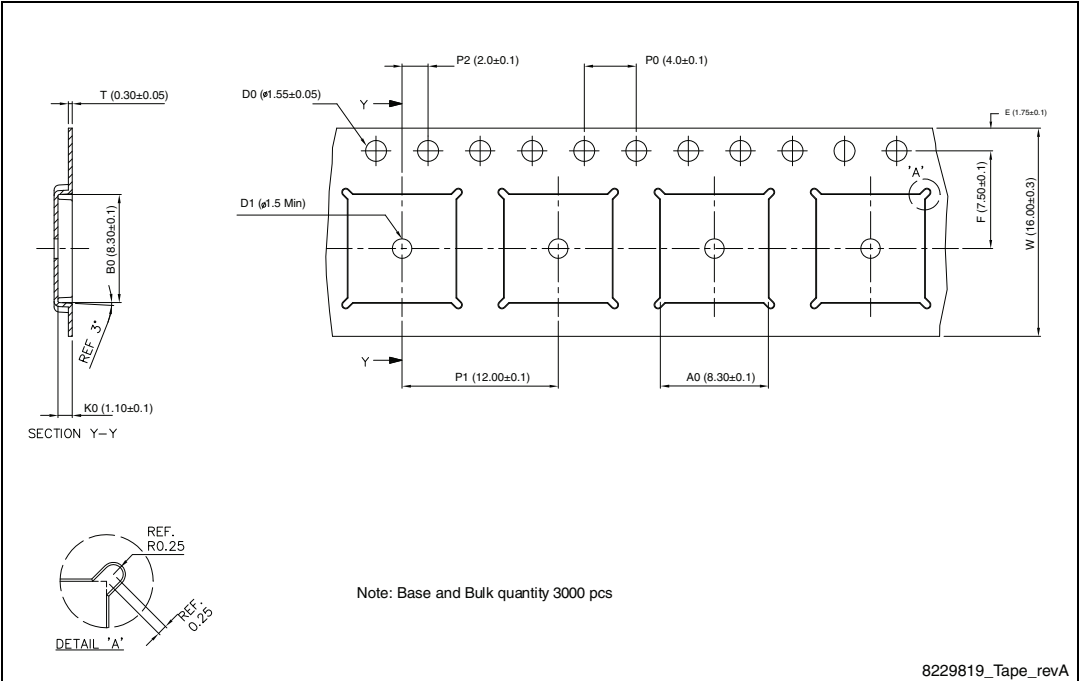


Figure 22. PowerFLAT™ 8x8 HV package orientation in carrier tape.

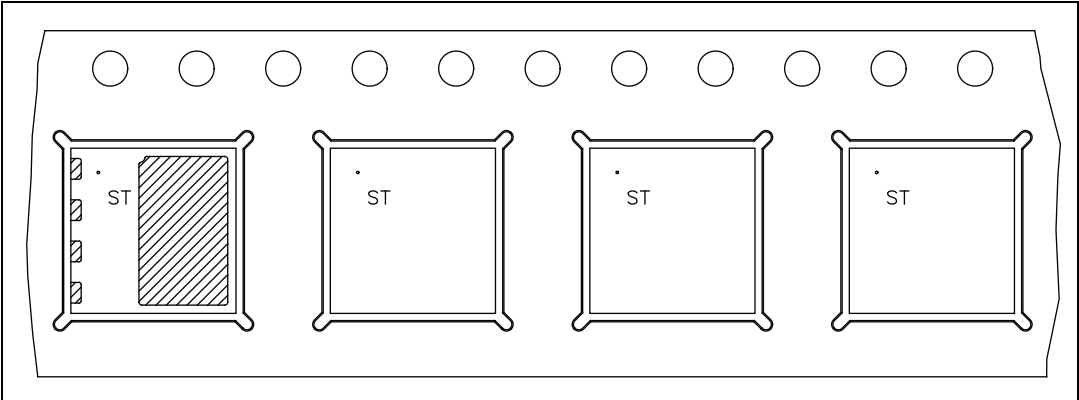


Figure 23. PowerFLAT™ 8x8 HV reel



6 Revision history

Table 9. Document revision history

Date	Revision	Changes
19-May-2011	1	First release.
03-Nov-2011	2	Section 4: Package mechanical data has been updated. Minor text changes.
28-Nov-2013	3	– Modified: title – Modified: V_{GS}, I_{AR}, E_{AS} values in Table 2 – Modified: note 2 in Table 2 – Modified: $R_{thj-amb}$ value in Table 3 – Modified: I_D value in Table 5 – Modified: the entire typical value in Table 6 – Modified: I_{SD} value in Table 6 – Modified: Figure 3, 4, 5, 13, 14, 15, and 16 – Updated: Section 4: Package mechanical data and added Section 5: Packaging mechanical data

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

ST PRODUCTS ARE NOT DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER'S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR "AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL" INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2013 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com