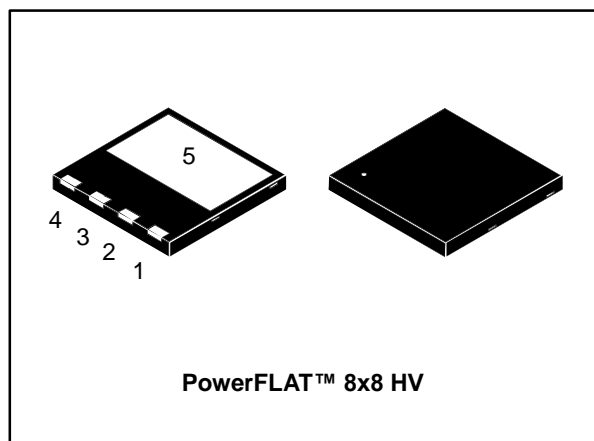
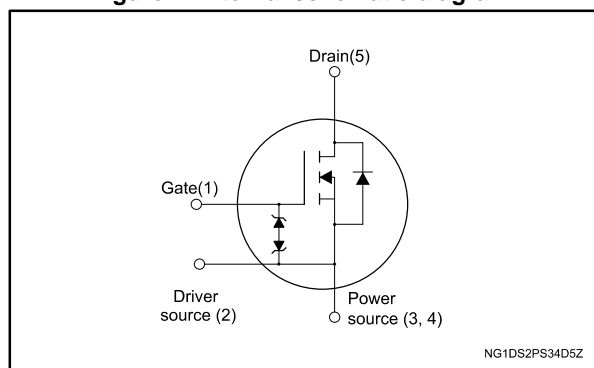


## N-channel 600 V, 0.186 $\Omega$ typ., 18 A MDmesh™ M2 Power MOSFET in a PowerFLAT™ 8x8 HV package

Datasheet - production data



**Figure 1: Internal schematic diagram**



### Features

Order code	V <sub>DS@TJ max</sub>	R <sub>DS(on) max.</sub>	I <sub>D</sub>
STL24N60M2	650 V	0.210 $\Omega$	18 A

- Extremely low gate charge
- Excellent output capacitance (C<sub>oss</sub>) profile
- 100% avalanche tested
- Zener-protected

### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using MDmesh™ M2 technology. Thanks to its strip layout and an improved vertical structure, the device exhibits low on-resistance and optimized switching characteristics, rendering it suitable for the most demanding high efficiency converters.

**Table 1: Device summary**

Order code	Marking	Package	Packing
STL24N60M2	24N60M2	PowerFLAT™ 8x8 HV	Tape and reel

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## Contents

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# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate-source voltage	$\pm 25$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ °C}$	18	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ °C}$	12	A
$I_{DM}^{(1)(2)}$	Drain current (pulsed)	72	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ °C}$	125	W
$dv/dt^{(3)}$	Peak diode recovery voltage slope	15	V/ns
$dv/dt^{(4)}$	MOSFET $dv/dt$ ruggedness	50	V/ns
$T_{stg}$	Storage temperature range	-55 to 150	°C
$T_j$	Operating junction temperature range		

**Notes:**

(1)the value is limited by package

(2)Pulse width limited by safe operating area.

(3) $I_{SD} \leq 18\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ;  $V_{DS(\text{peak})} < V_{(BR)DSS}$ ,  $V_{DD} = 400\text{ V}$ .

(4) $V_{DS} \leq 480\text{ V}$

**Table 3: Thermal data**

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

**Notes:**

(1)When mounted on FR-4 board of  $\text{inch}^2$ , 2oz Cu.

**Table 4: Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not repetitive (pulse width limited by $T_{j\text{max}}$ )	3.5	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ °C}$ , $I_D = I_{AR}$ ; $V_{DD} = 50\text{ V}$ )	180	mJ

## 2 Electrical characteristics

$T_C = 25\text{ °C}$  unless otherwise specified

**Table 5: On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$	600			V
$I_{DSS}$	Zero gate voltage Drain current	$V_{GS} = 0\text{ V}$ , $V_{DS} = 600\text{ V}$			1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$ , $V_{DS} = 600\text{ V}$ , $T_C = 125\text{ °C}^{(1)}$			100	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 25\text{ V}$			$\pm 10$	$\mu\text{A}$
$V_{GS(th)}$	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	$V_{GS} = 10\text{ V}$ , $I_D = 9\text{ A}$		0.186	0.210	$\Omega$

**Notes:**

<sup>(1)</sup>Defined by design, not subject to production test.

**Table 6: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	1060	-	pF
$C_{oss}$	Output capacitance		-	55	-	pF
$C_{rSS}$	Reverse transfer capacitance		-	2.2	-	pF
$C_{oss\ eq.}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }480\text{ V}$ , $V_{GS} = 0\text{ V}$	-	258	-	pF
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	7	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 480\text{ V}$ , $I_D = 18\text{ A}$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15: "Gate charge test circuit"</a> )	-	29	-	nC
$Q_{gs}$	Gate-source charge		-	6	-	nC
$Q_{gd}$	Gate-drain charge		-	12	-	nC

**Notes:**

<sup>(1)</sup> $C_{oss\ eq.}$  is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$

**Table 7: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$ , $I_D = 9\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 14: "Switching times test circuit for resistive load"</a> ) and ( <a href="#">Figure 19: "Switching time waveform"</a> )	-	14	-	ns
$t_r$	Rise time		-	9	-	ns
$t_{d(off)}$	Turn-off delay time		-	60	-	ns
$t_f$	Fall time		-	15	-	ns

Table 8: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Source-drain current		-		18	A
$I_{SDM}^{(1)(2)}$	Source-drain current (pulsed)		-		72	A
$V_{SD}^{(3)}$	Forward on voltage	$V_{GS} = 0\text{ V}$ , $I_{SD} = 18\text{ A}$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 18\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 60\text{ V}$ (see <a href="#">Figure 16: "Test circuit for inductive load switching and diode recovery times"</a> )	-	332		ns
$Q_{rr}$	Reverse recovery charge		-	4		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	24		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 18\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 60\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ (see <a href="#">Figure 16: "Test circuit for inductive load switching and diode recovery times"</a> )	-	450		ns
$Q_{rr}$	Reverse recovery charge		-	5.5		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	25		A

**Notes:**

- (1)The value is limited by package.  
(2)Pulse width is limited by safe operating area  
(3)Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

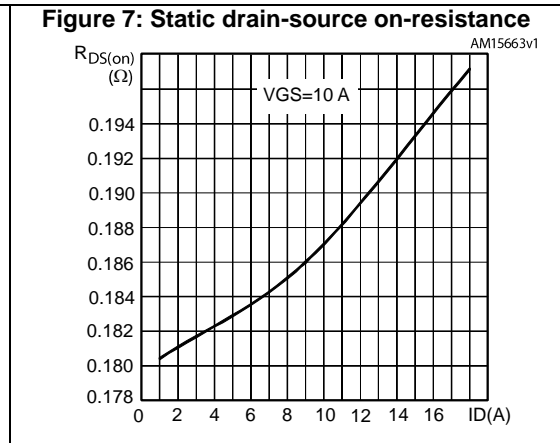
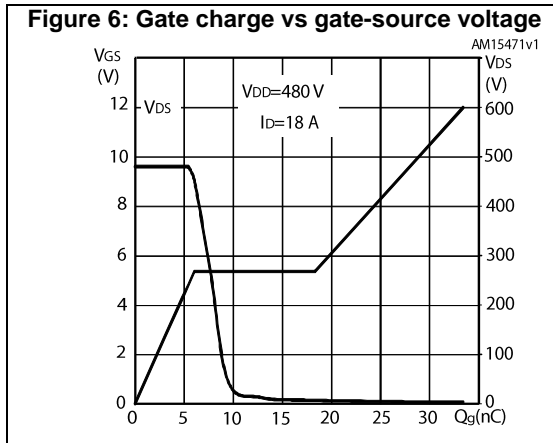
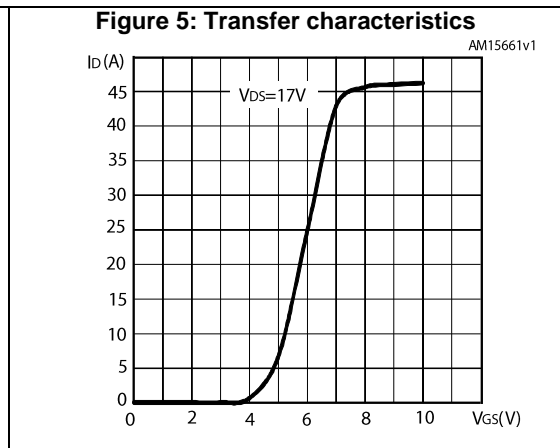
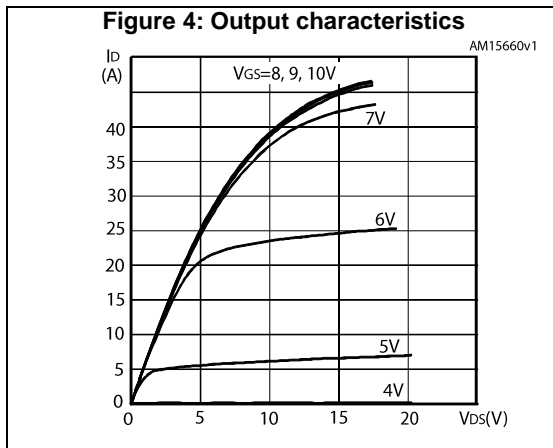
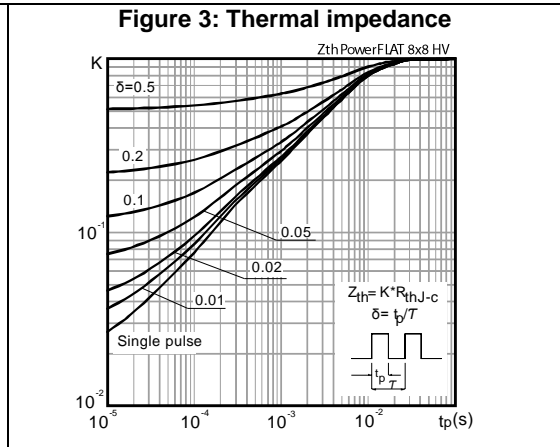
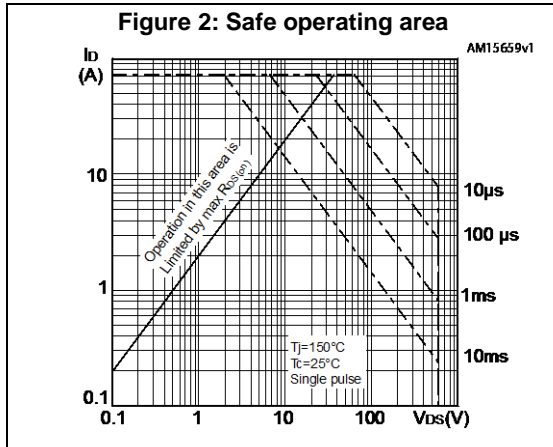


Figure 8: Capacitance variations

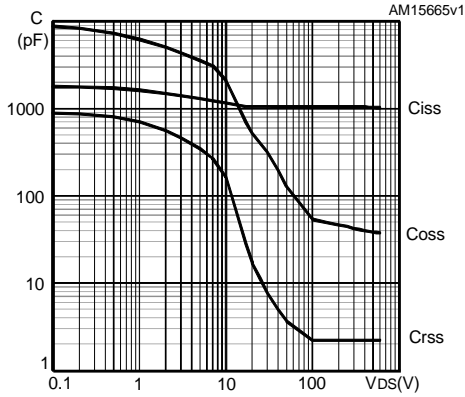


Figure 9: Normalized gate threshold voltage vs temperature

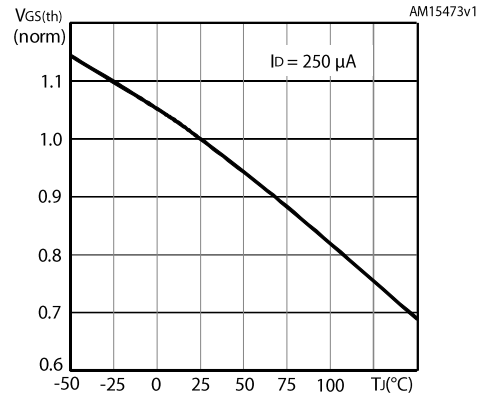


Figure 10: Normalized on-resistance vs temperature

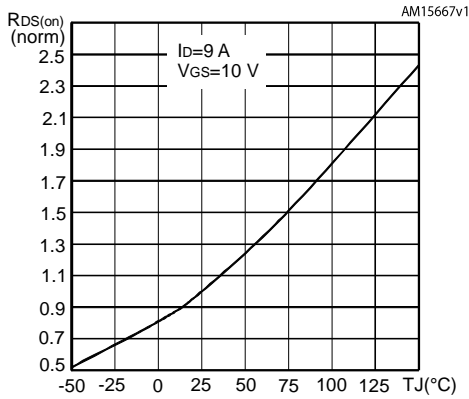


Figure 11: Normalized V(BR)DSS vs temperature

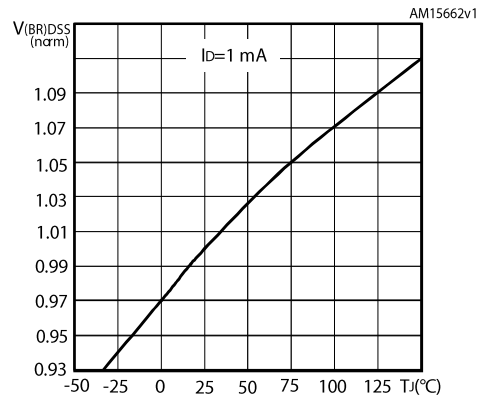


Figure 12: Output capacitance stored energy

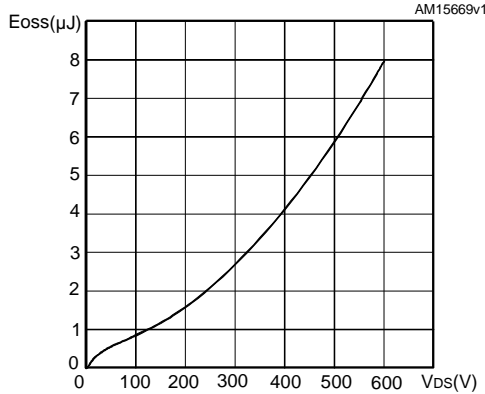
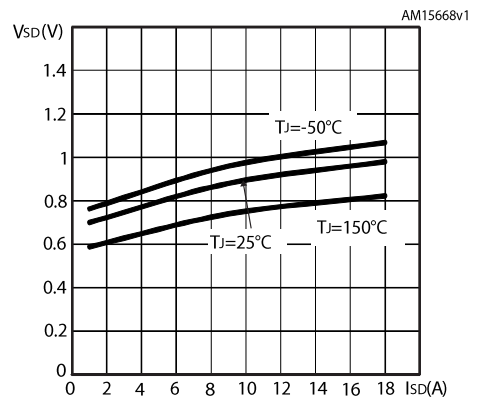
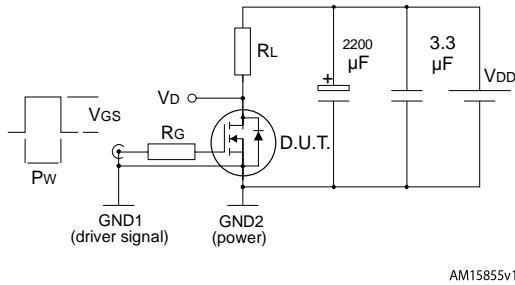


Figure 13: Source-drain diode forward characteristics



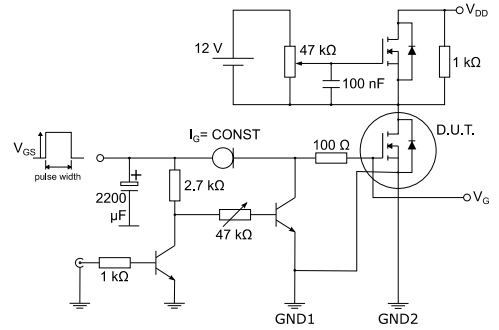
### 3 Test circuits

**Figure 14: Switching times test circuit for resistive load**



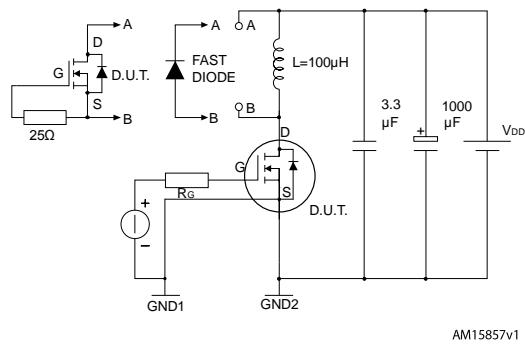
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**Figure 15: Gate charge test circuit**



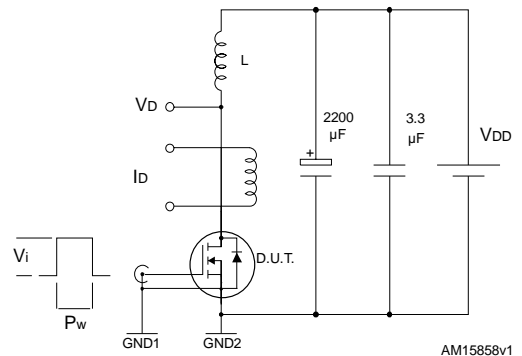
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**Figure 16: Test circuit for inductive load switching and diode recovery times**



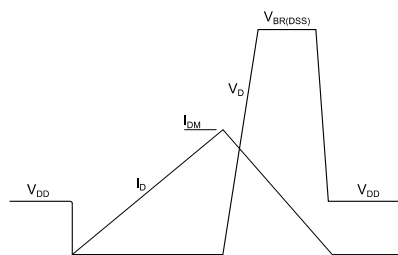
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**Figure 17: Unclamped inductive load test circuit**



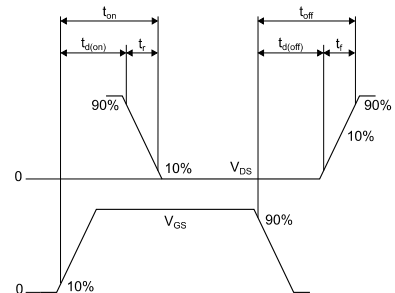
AM15858v1

**Figure 18: Unclamped inductive waveform**



AM01472v1

**Figure 19: Switching time waveform**



AM01473v1



## 4 Package information

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](http://www.st.com). ECOPACK® is an ST trademark.

### 4.1 PowerFLAT™ 8x8 HV package information

Figure 20: PowerFLAT™ 8x8 HV package outline

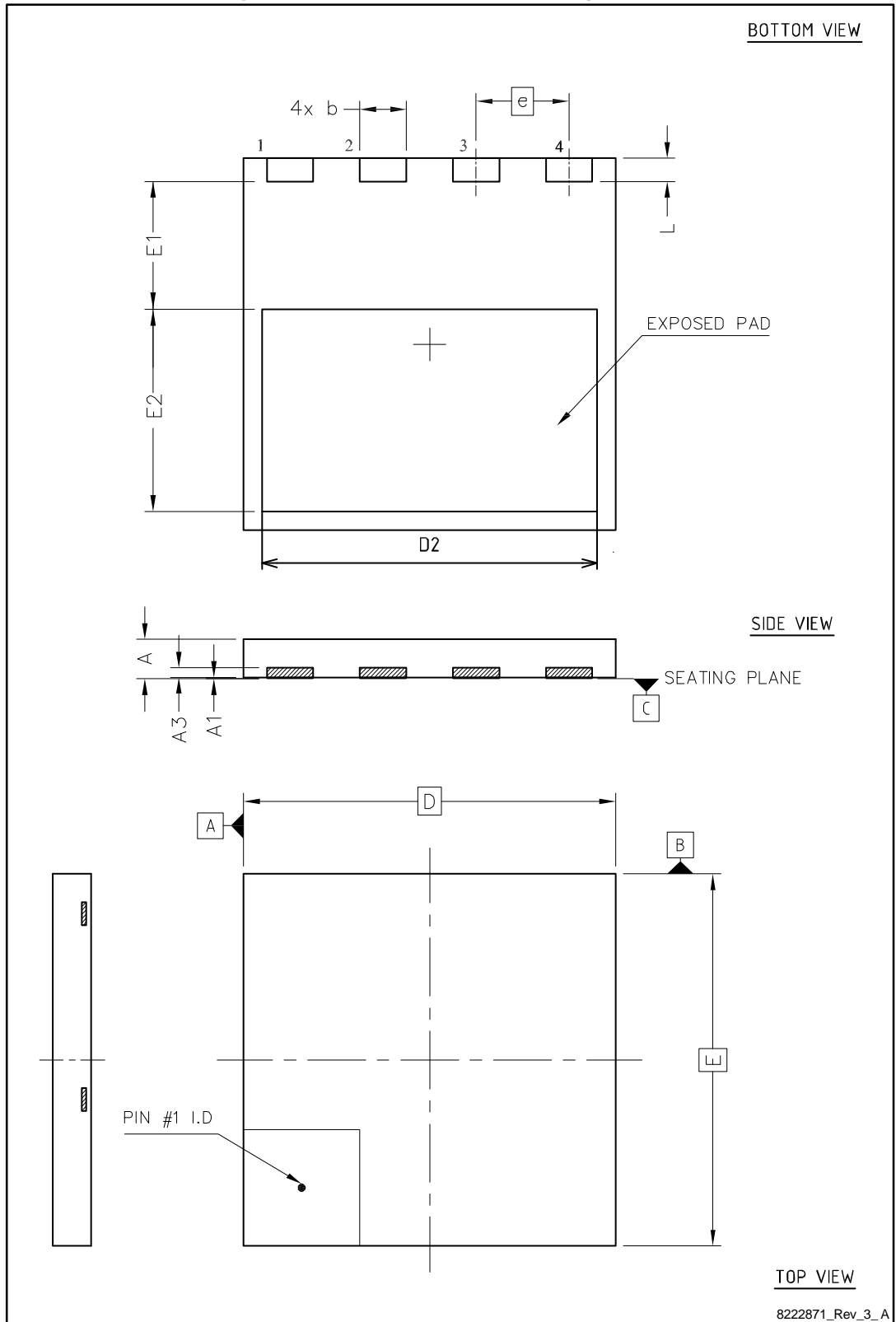
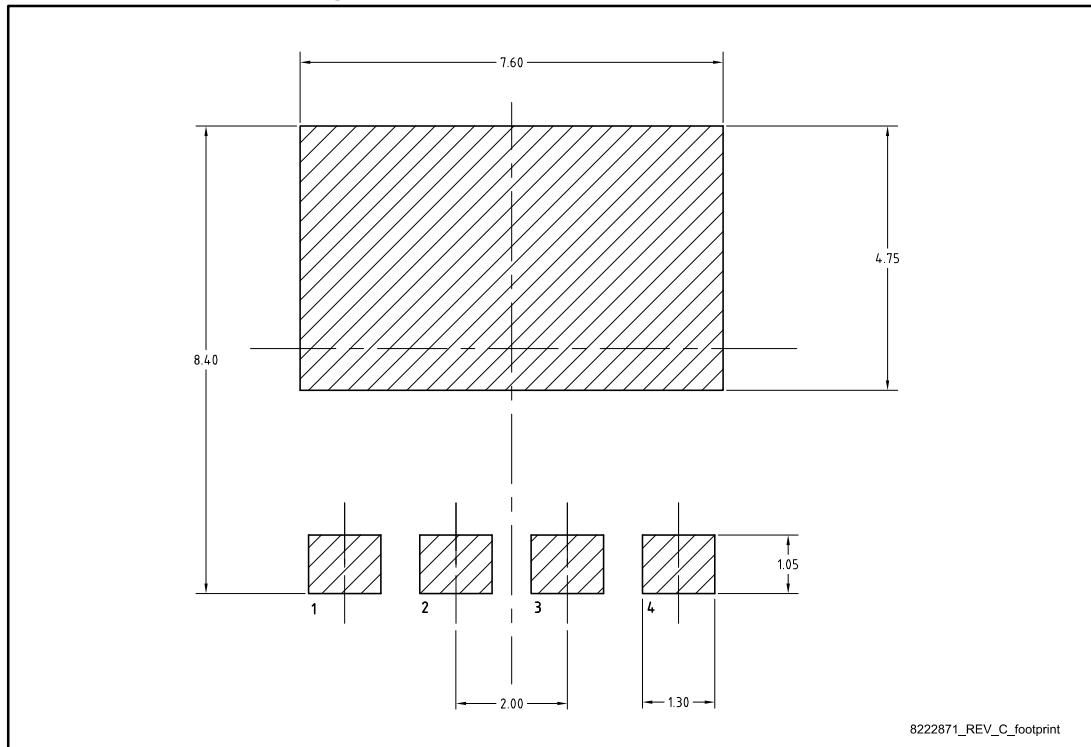


Table 9: PowerFLAT™ 8x8 HV mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.75	0.85	0.95
A1	0.00		0.05
A3	0.10	0.20	0.30
b	0.90	1.00	1.10
D	7.90	8.00	8.10
E	7.90	8.00	8.10
D2	7.10	7.20	7.30
E1	2.65	2.75	2.85
E2	4.25	4.35	4.45
e		2.00	
L	0.40	0.50	0.60

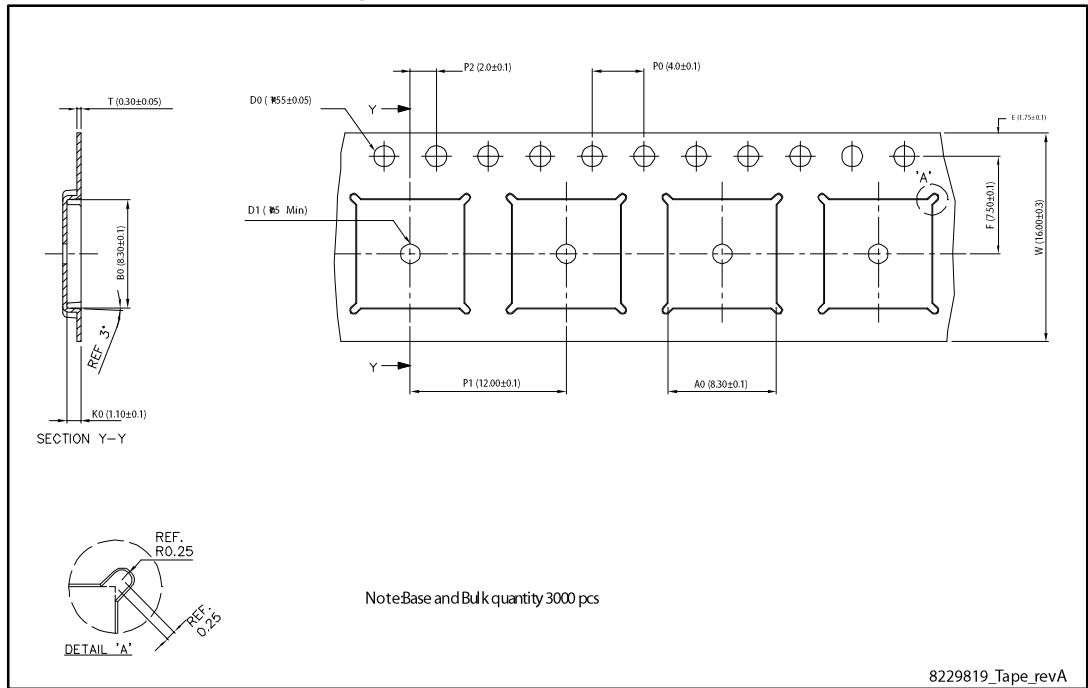
Figure 21: PowerFLAT™ 8x8 HV footprint



All dimensions are in millimeters.

### 4.2 PowerFLAT™ 8x8 HV packing information

Figure 22: PowerFLAT™ 8x8 HV tape



All dimensions are in millimeters.

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

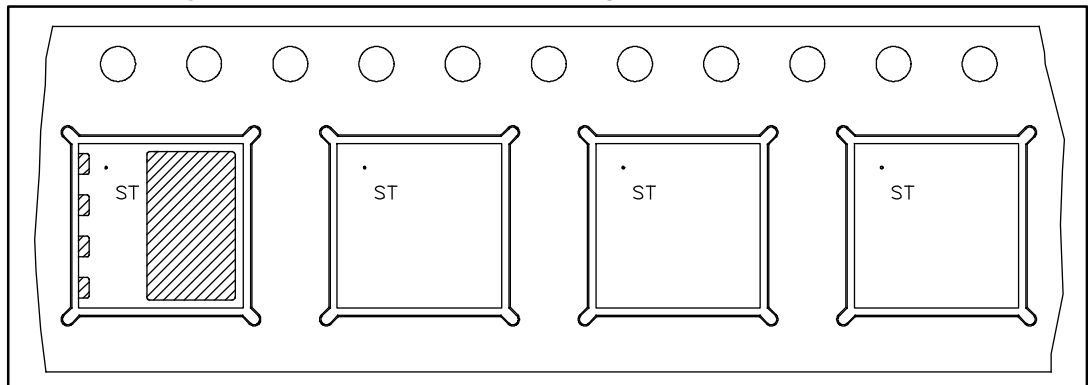
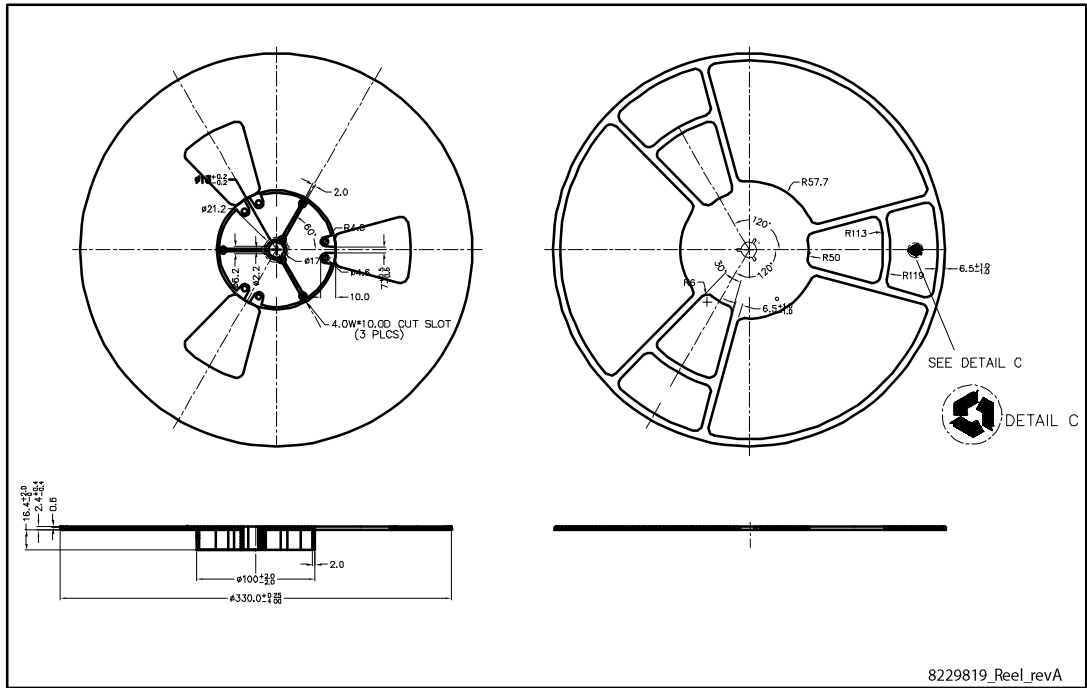


Figure 24: PowerFLAT™ 8x8 HV reel



All dimensions are in millimeters.

## 5 Revision history

**Table 10: Document revision history**

Date	Revision	Changes
11-Jun-2013	1	First release.
28-Feb-2014	2	Modified: $I_D$ (at $T_C = 100\text{ °C}$ ) value in Table 3. Modified: $V_{SD}$ max value, figures 3 and 11. Updated: Section 4: Package mechanical data – Minor text changes.
25-May-2016	3	Updated features and description in cover page. Updated package silhouette and <i>Figure 1: "Internal schematic diagram"</i> . Updated <i>Section 4: "Test circuits"</i> and <i>Section 5.1: "PowerFLAT™ 8x8 HV package information"</i> . Minor text changes

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