

## N-channel 600 V, 0.195 $\Omega$ typ., 15 A MDmesh™ DM2 Power MOSFET in a PowerFLAT™ 8x8 HV package

Datasheet - production data

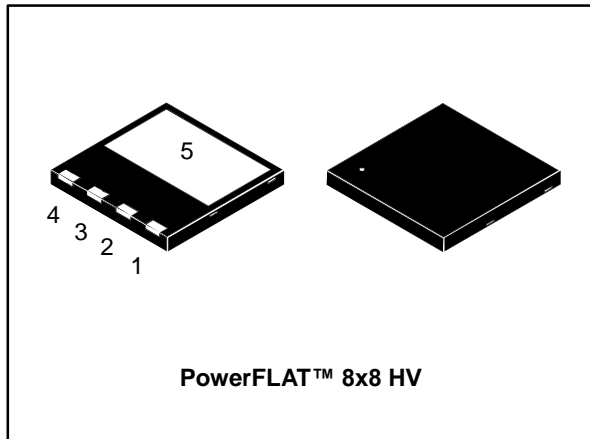


Figure 1: Internal schematic diagram

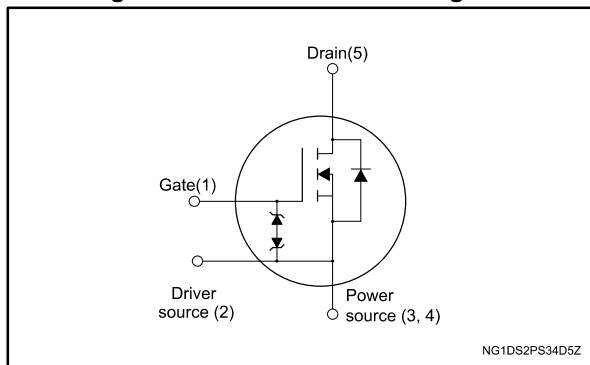


Table 1: Device summary

Order code	Marking	Package	Packing
STL24N60DM2	24N60DM2	PowerFLAT™ 8x8 HV	Tape and reel

### Features

Order code	V <sub>DS</sub> @ T <sub>Jmax</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STL24N60DM2	650 V	0.220 $\Omega$	15 A

- Fast-recovery body diode
- Extremely low gate charge and input capacitance
- Low on-resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness
- Zener-protected

### Applications

- Switching applications

### Description

This high voltage N-channel Power MOSFET is part of the MDmesh™ DM2 fast recovery diode series. It offers very low recovery charge ( $Q_{rr}$ ) and time ( $t_{rr}$ ) combined with low  $R_{DS(on)}$ , rendering it suitable for the most demanding high efficiency converters and ideal for bridge topologies and ZVS phase-shift converters.

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# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate-source voltage	±25	V
$I_D^{(1)}$	Drain current (continuous) at $T_{case} = 25\text{ °C}$	15	A
	Drain current (continuous) at $T_{case} = 100\text{ °C}$	9.5	
$I_{DM}^{(1)(2)}$	Drain current (pulsed)	60	A
$P_{TOT}^{(1)}$	Total dissipation at $T_{case} = 25\text{ °C}$	125	W
$dv/dt^{(3)}$	Peak diode recovery voltage slope	40	V/ns
$dv/dt^{(4)}$	MOSFET $dv/dt$ ruggedness	50	
$T_{stg}$	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)  $I_{SD} \leq 15\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DS(peak)} < V_{(BR)DSS}$ ,  $V_{DD} = 400\text{ V}$   
 (4)  $V_{DS} \leq 480\text{ V}$ .

**Table 3: Thermal data**

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

**Notes:**

- (1) When mounted on FR-4 board of inch<sup>2</sup>, 2oz Cu.

**Table 4: Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not repetitive (pulse width limited by $T_{jmax}$ )	3	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ °C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	160	mJ

## 2 Electrical characteristics

( $T_{\text{case}} = 25\text{ °C}$  unless otherwise specified)

**Table 5: On/off-state**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$ , $I_{\text{D}} = 1\text{ mA}$	600			V
$I_{\text{DSS}}$	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 600\text{ V}$			1.5	$\mu\text{A}$
		$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 600\text{ V}$ , $T_{\text{case}} = 125\text{ °C}$			100	
$I_{\text{GSS}}$	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$ , $V_{\text{GS}} = \pm 25\text{ V}$			$\pm 10$	$\mu\text{A}$
$V_{\text{GS}(\text{th})}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$ , $I_{\text{D}} = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{\text{DS}(\text{on})}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$ , $I_{\text{D}} = 9\text{ A}$		0.195	0.220	$\Omega$

**Table 6: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{\text{iss}}$	Input capacitance	$V_{\text{DS}} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{\text{GS}} = 0\text{ V}$	-	1055	-	$\text{pF}$
$C_{\text{oss}}$	Output capacitance		-	56	-	
$C_{\text{riss}}$	Reverse transfer capacitance		-	2.4	-	
$C_{\text{oss eq.}}^{(1)}$	Equivalent output capacitance	$V_{\text{DS}} = 0\text{ to }480\text{ V}$ , $V_{\text{GS}} = 0\text{ V}$	-	259	-	$\text{pF}$
$R_{\text{G}}$	Intrinsic gate resistance	$f = 1\text{ MHz}$ , $I_{\text{D}} = 0\text{ A}$	-	7	-	$\Omega$
$Q_{\text{g}}$	Total gate charge	$V_{\text{DD}} = 480\text{ V}$ , $I_{\text{D}} = 18\text{ A}$ , $V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 15: "Gate charge test circuit"</a> )	-	29	-	$\text{nC}$
$Q_{\text{gs}}$	Gate-source charge		-	6	-	
$Q_{\text{gd}}$	Gate-drain charge		-	12	-	

**Notes:**

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

**Table 7: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d}(\text{on})}$	Turn-on delay time	$V_{\text{DD}} = 300\text{ V}$ , $I_{\text{D}} = 9\text{ A}$ , $R_{\text{G}} = 4.7\text{ }\Omega$ , $V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 14: "Switching times test circuit for resistive load"</a> and <a href="#">Figure 19: "Switching time waveform"</a> )	-	15	-	ns
$t_{\text{r}}$	Rise time		-	8.7	-	
$t_{\text{d}(\text{off})}$	Turn-off delay time		-	60	-	
$t_{\text{f}}$	Fall time		-	15	-	

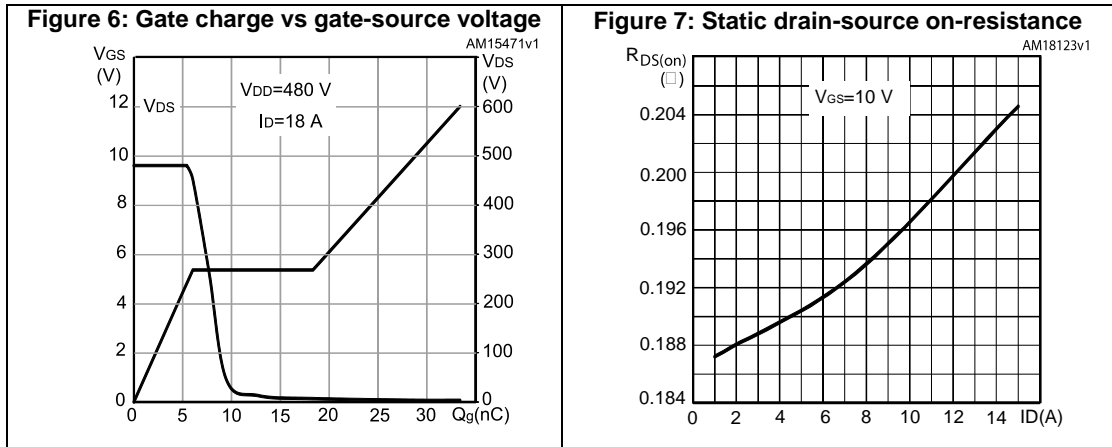
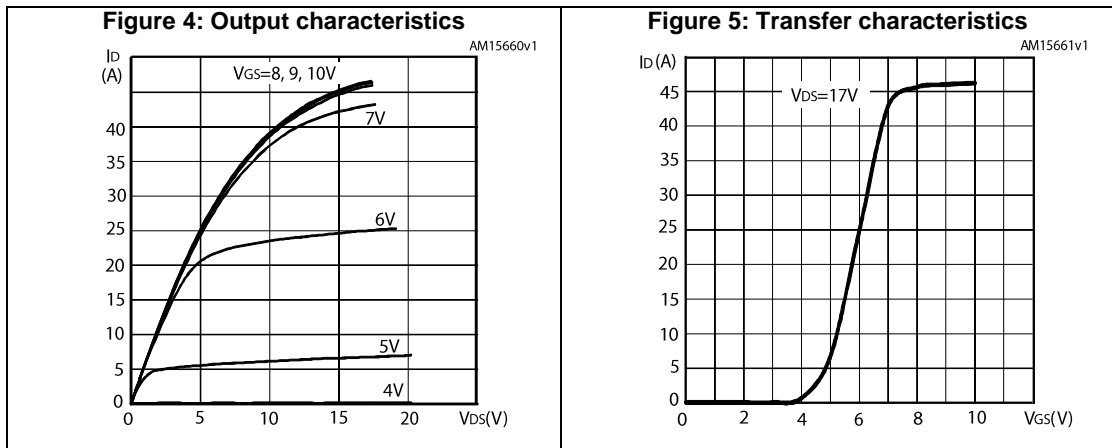
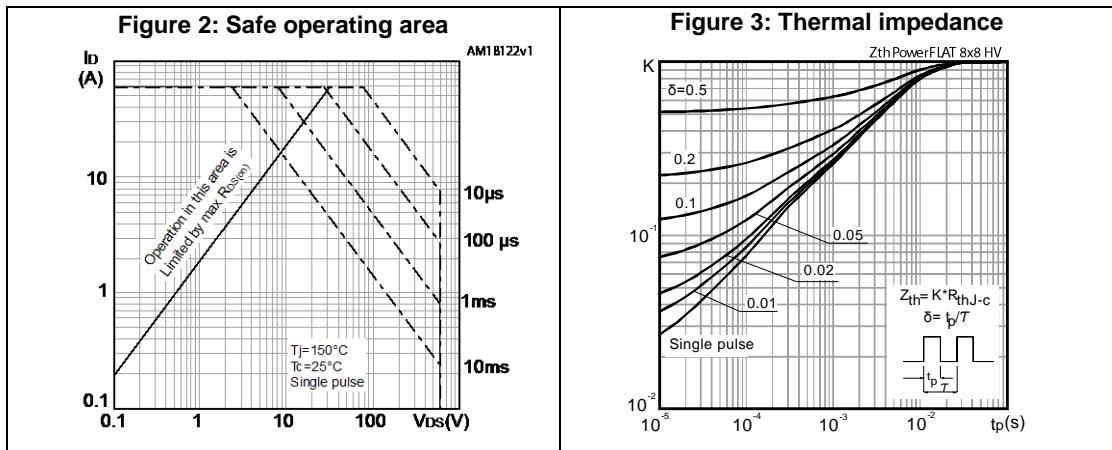
Table 8: Source-drain diode

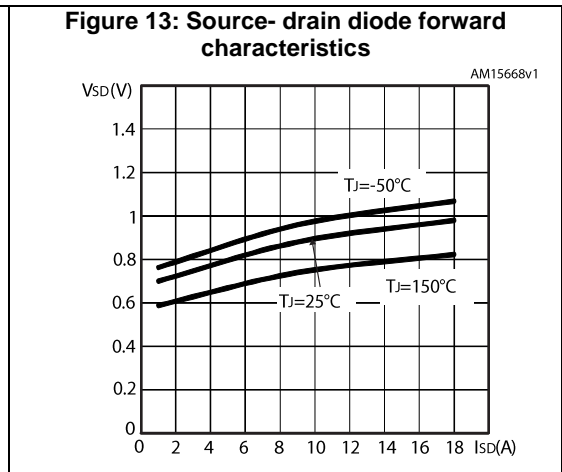
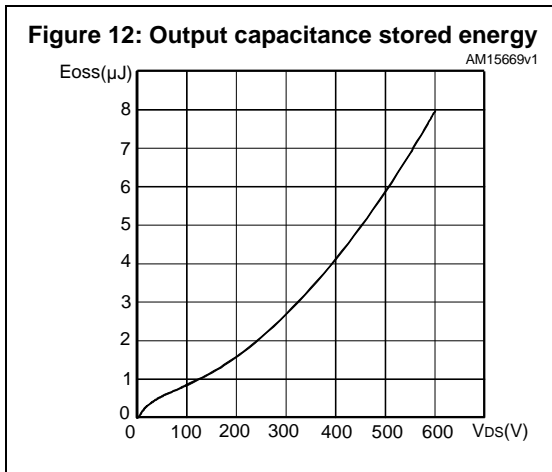
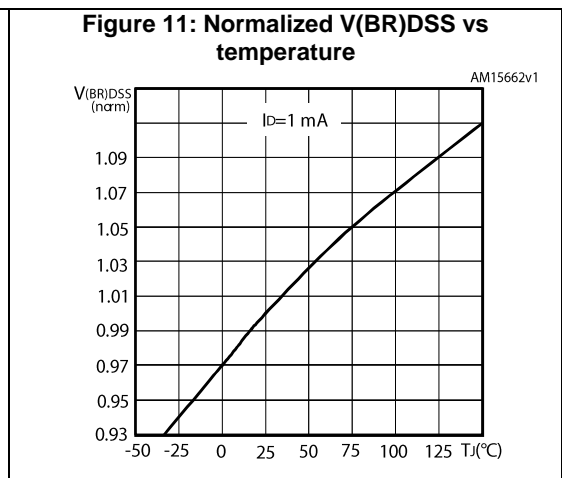
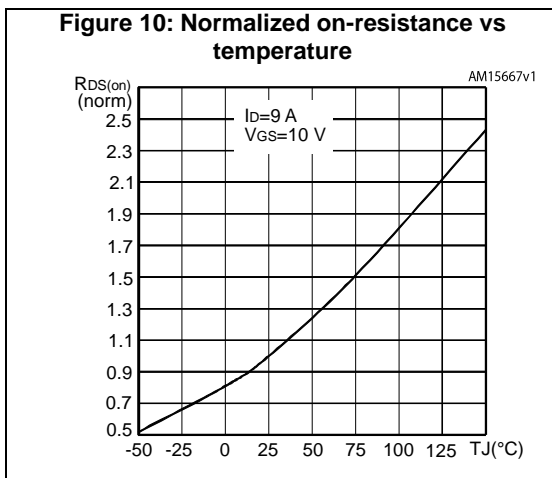
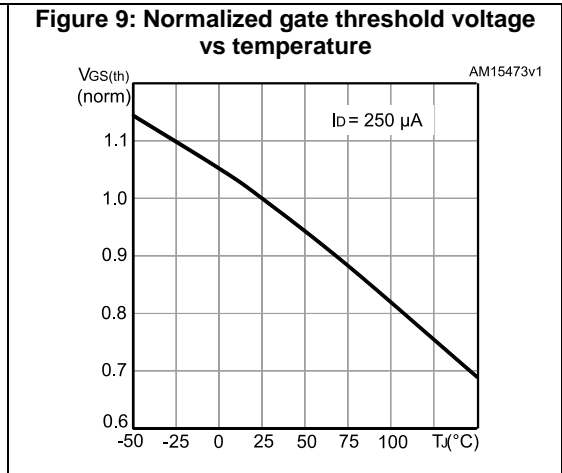
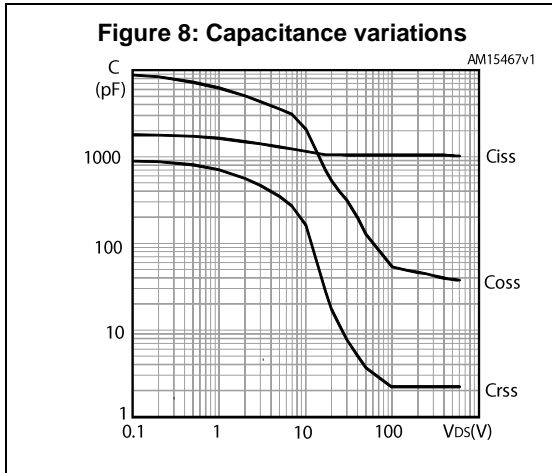
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Source-drain current		-		15	A
$I_{SDM}^{(2)}$	Source-drain current (pulsed)		-		60	A
$V_{SD}^{(3)}$	Forward on voltage	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 18 \text{ A}$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 18 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 60 \text{ V}$ (see <a href="#">Figure 16: "Test circuit for inductive load switching and diode recovery times"</a> )	-	155		ns
$Q_{rr}$	Reverse recovery charge		-	956		nC
$I_{RRM}$	Reverse recovery current		-	12.5		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> )	-	200		ns
$Q_{rr}$	Reverse recovery charge		-	1450		nC
$I_{RRM}$	Reverse recovery current		-	13		A

**Notes:**

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

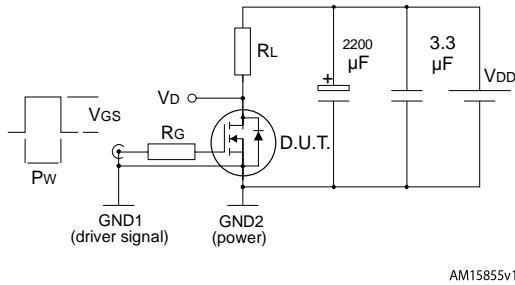
## 2.1 Electrical characteristics (curves)





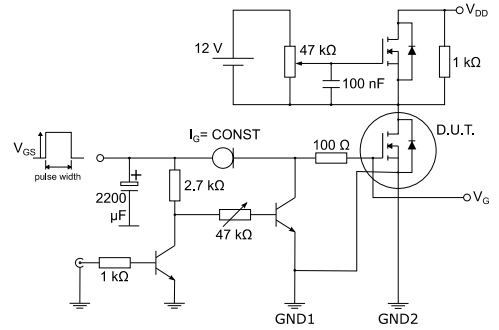
### 3 Test circuits

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



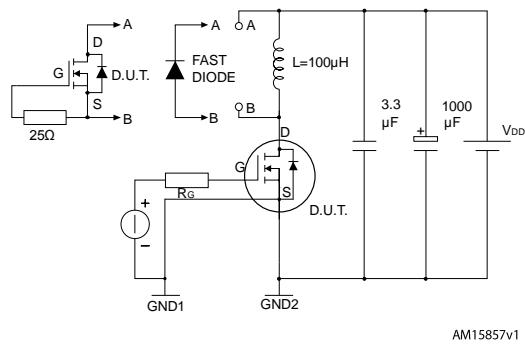
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**Figure 15: Gate charge test circuit**



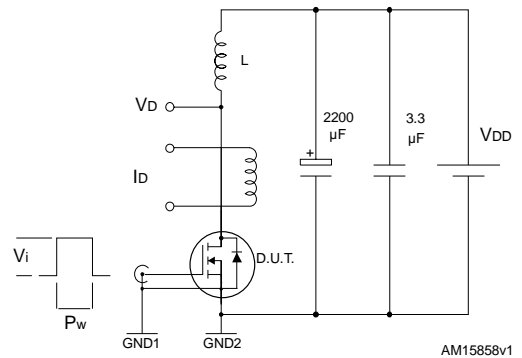
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**Figure 16: Test circuit for inductive load switching and diode recovery times**



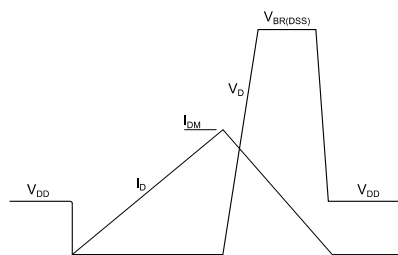
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**Figure 17: Unclamped inductive load test circuit**



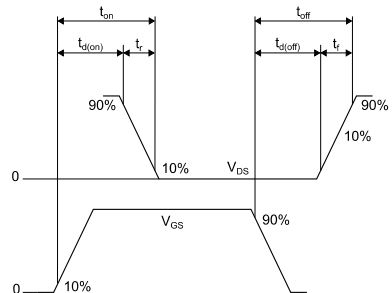
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**Figure 18: Unclamped inductive waveform**



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**Figure 19: Switching time waveform**



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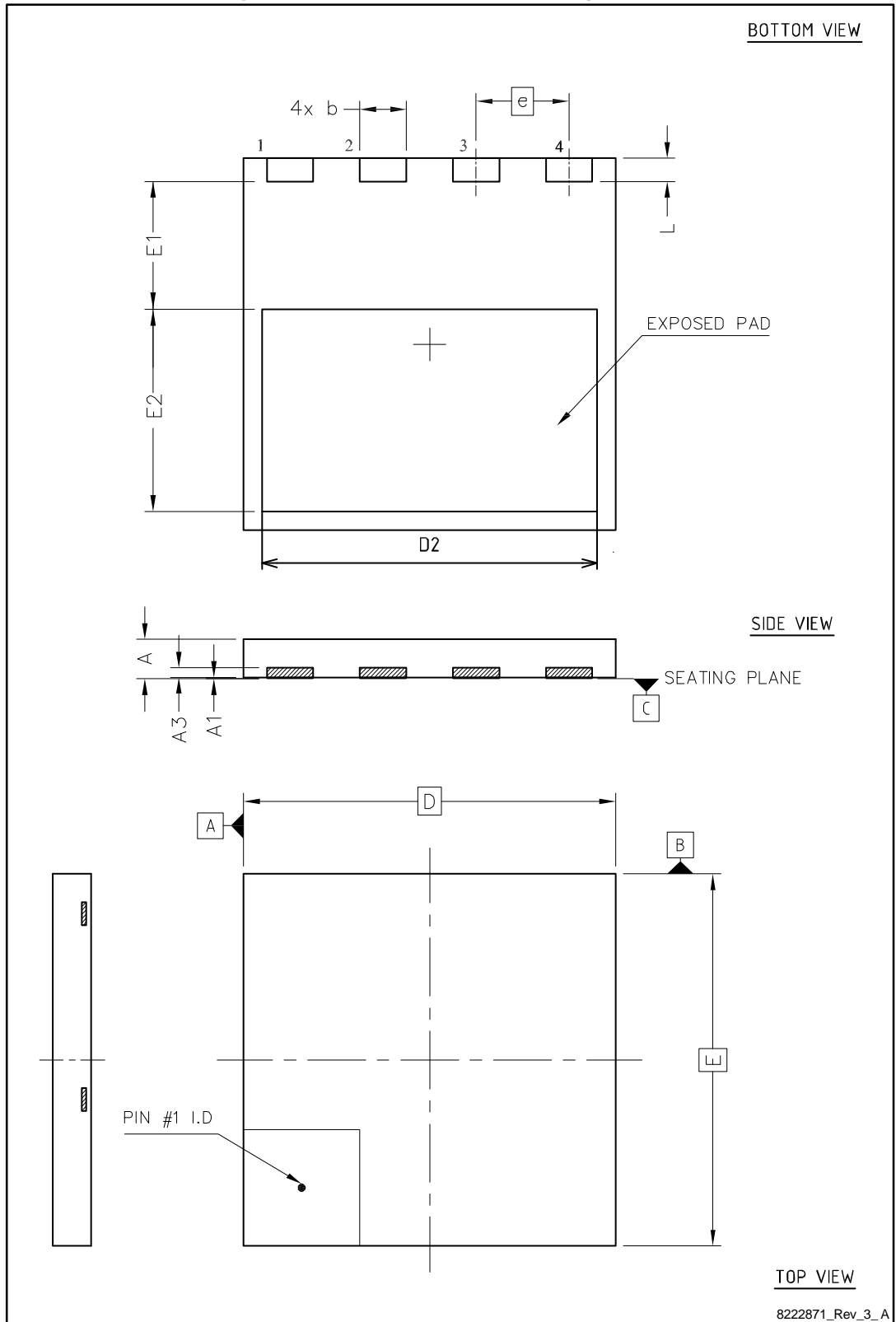


## 4 Package information

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 PowerFLAT8x8 HV package information

Figure 20: PowerFLAT™ 8x8 HV package outline

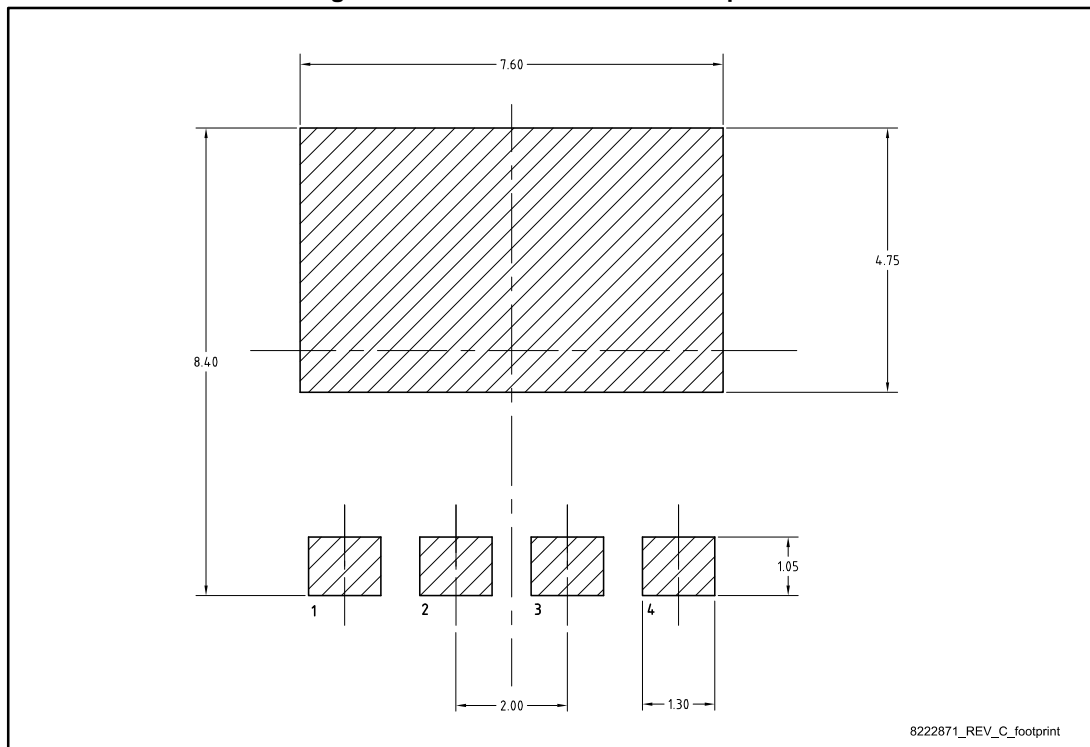


8222871\_Rev\_3\_A

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

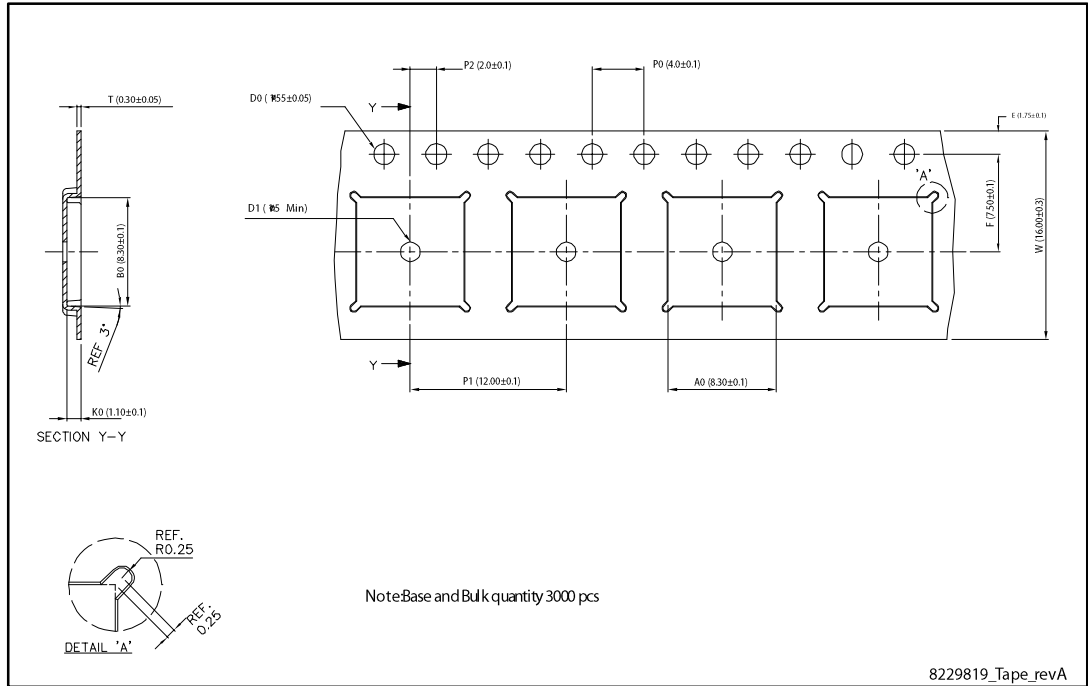
Figure 21: PowerFLAT™ 8x8 HV footprint



All dimensions are in millimeters.

### 4.2 PowerFLAT 8x8 HV packaging information

Figure 22: PowerFLAT™ 8x8 HV tape



All dimensions are in millimeters.

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

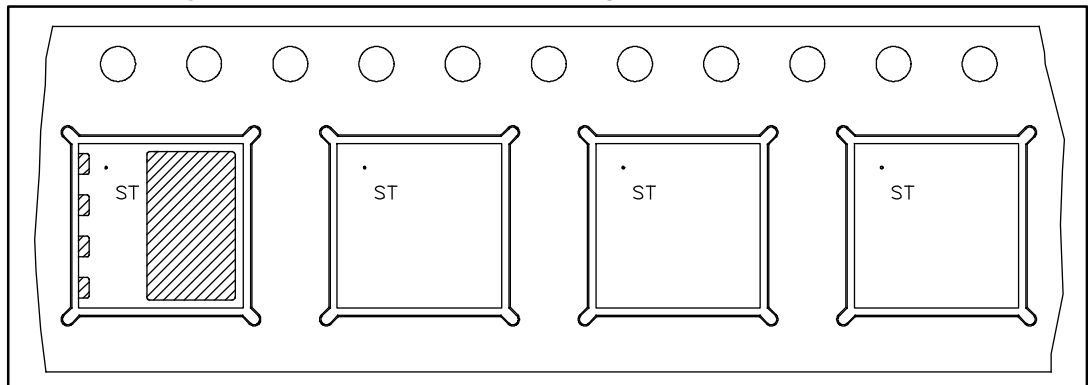
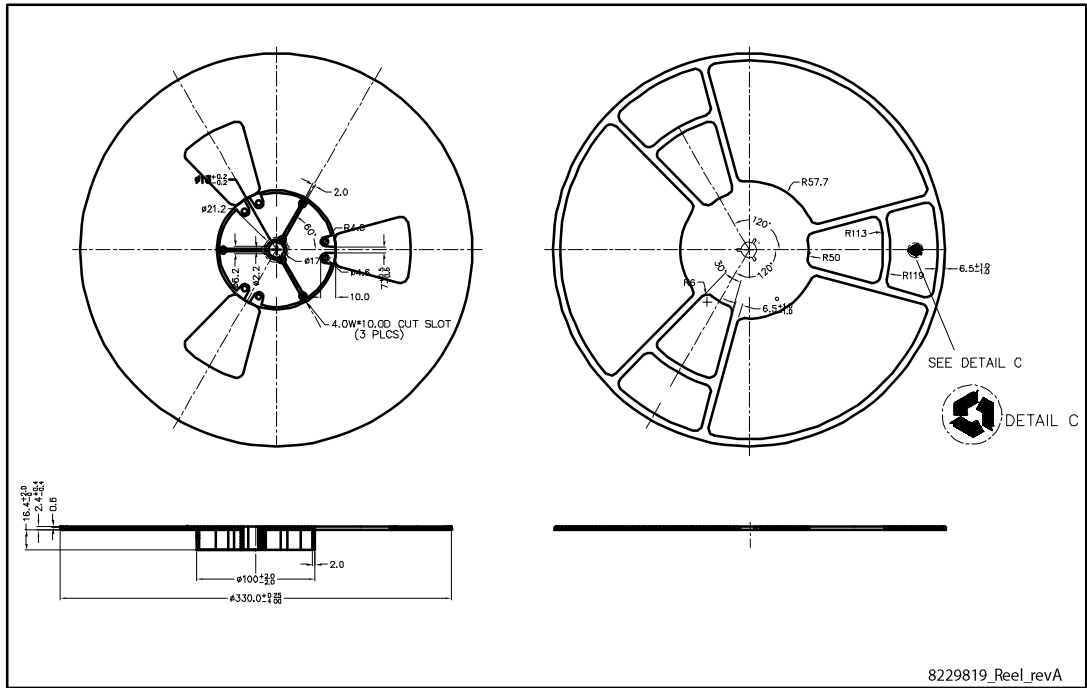


Figure 24: PowerFLAT™ 8x8 HV reel



All dimensions are in millimeters.

## 5 Revision history

Table 10: Document revision history

Date	Revision	Changes
03-Mar-2014	1	First release.
21-Jan-2016	2	Modified: title, features, description and internal schematic in cover page Modified: <i>Section 3: "Test circuits"</i> Updated: <i>Section 4: "Package information"</i> Minor text changes
25-Jul-2016	3	Document status promoted from preliminary to production data.

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