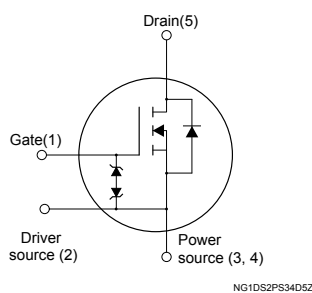
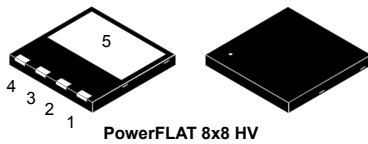


## N-channel 600 V, 72 mΩ typ., 45 A, MDmesh DM6 Power MOSFET in a PowerFLAT 8x8 HV package



### Features

Order code	$V_{DS}$	$R_{DS(on)}$ max.	$I_D$
STL52N60DM6	600 V	84 mΩ	45 A

- Fast-recovery body diode
- Lower  $R_{DS(on)}$  per area vs previous generation
- Low gate charge, input capacitance and resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness
- Zener-protected
- Excellent switching performance thanks to the extra driving source pin

### Applications

- Switching applications

### Description

This high-voltage N-channel Power MOSFET is part of the MDmesh DM6 fast-recovery diode series. Compared with the previous MDmesh fast generation, DM6 combines very low recovery charge ( $Q_{rr}$ ), recovery time ( $t_{rr}$ ) and excellent improvement in  $R_{DS(on)}$  per area with one of the most effective switching behaviors available in the market for the most demanding high-efficiency bridge topologies and ZVS phase-shift converters.



#### Product status link

[STL52N60DM6](#)

#### Product summary

<b>Order code</b>	STL52N60DM6
<b>Marking</b>	52N60DM6
<b>Package</b>	PowerFLAT 8x8 HV
<b>Packing</b>	Tape and reel

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate-source voltage	$\pm 25$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	45	A
	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	28	A
$I_{DM}^{(2)}$	Drain current (pulsed)	128	A
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ }^\circ\text{C}$	174	W
$dv/dt^{(3)}$	Peak diode recovery voltage slope	100	V/ns
$di/dt^{(3)}$	Peak diode recovery current slope	1000	A/ $\mu\text{s}$
$dv/dt^{(4)}$	MOSFET $dv/dt$ ruggedness	100	V/ns
$T_{stg}$	Storage temperature range	-55 to 150	$^\circ\text{C}$
$T_J$	Operating junction temperature range		$^\circ\text{C}$

1. Referred to TO-247 package.
2. Pulse width is limited by safe operating area.
3.  $I_{SD} \leq 45\text{ A}$ ,  $V_{DS} (\text{peak}) < V_{(BR)DSS}$ ,  $V_{DD} = 400\text{ V}$
4.  $V_{DS} \leq 480\text{ V}$ .

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case	0.72	$^\circ\text{C/W}$
$R_{thJB}^{(1)}$	Thermal resistance, junction-to-board	45	$^\circ\text{C/W}$

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

**Table 3. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not repetitive (pulse width limited by $T_J$ max.)	8	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	690	mJ

## 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	$V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$	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	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 25\text{ V}$			$\pm 5$	$\mu\text{A}$
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	3.25	4.00	4.75	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$ , $I_D = 22.5\text{ A}$		72	84	m $\Omega$

1. Defined by design, not subject to production test.

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	2468	-	pF
$C_{oss}$	Output capacitance		-	178	-	pF
$C_{rSS}$	Reverse transfer capacitance		-	1.47	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }480\text{ V}$ , $V_{GS} = 0\text{ V}$	-	416	-	pF
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz}$ , $I_D = 0\text{ A}$	-	1.6	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 480\text{ V}$ , $I_D = 40\text{ A}$ , $V_{GS} = 0\text{ to }10\text{ V}$ (see Figure 14. Test circuit for gate charge behavior)	-	52	-	nC
$Q_{gs}$	Gate-source charge		-	16	-	nC
$Q_{gd}$	Gate-drain charge		-	19	-	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%  $V_{DSS}$ .

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$ , $I_D = 20\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$	-	19.4	-	ns
$t_r$	Rise time		-	4.3	-	ns
$t_{d(off)}$	Turn-off delay time	(see Figure 13. Switching times test circuit for resistive load and Figure 18. Switching time waveform)	-	63	-	ns
$t_f$	Fall time		-	9.2	-	ns

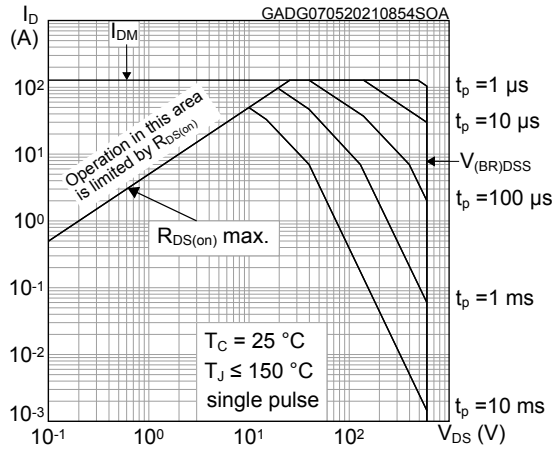
**Table 7. Source-drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		45	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		128	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$ , $I_{SD} = 45\text{ A}$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 40\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,	-	134		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 100\text{ V}$	-	0.78		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	(see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	10		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 40\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,	-	241		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 100\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$	-	2.72		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	(see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	19.4		A

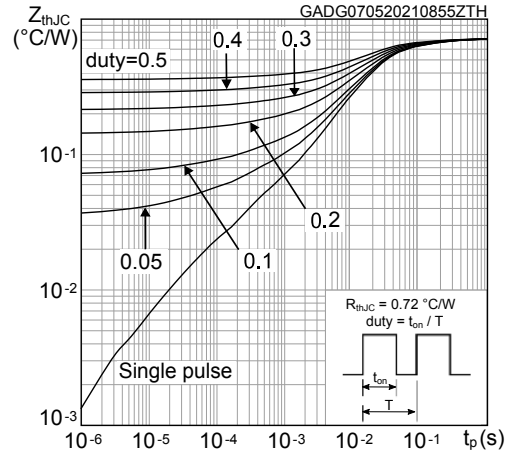
1. Pulse width is limited by safe operating area.
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.

## 2.1 Electrical characteristics (curves)

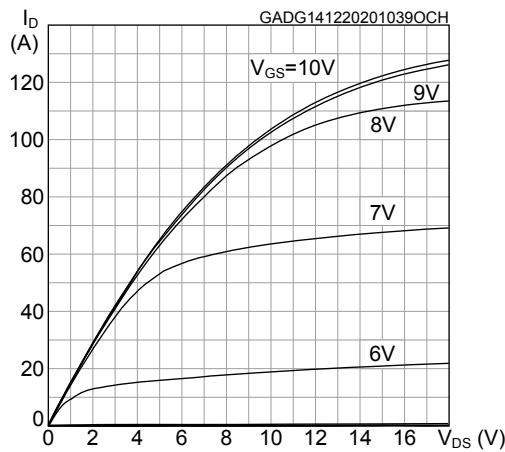
**Figure 1. Safe operating area**



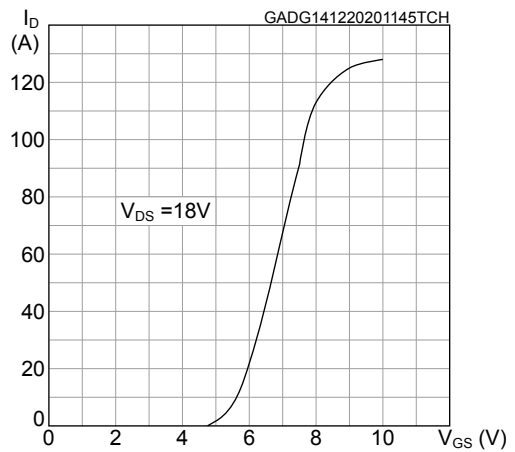
**Figure 2. Maximum transient thermal impedance**



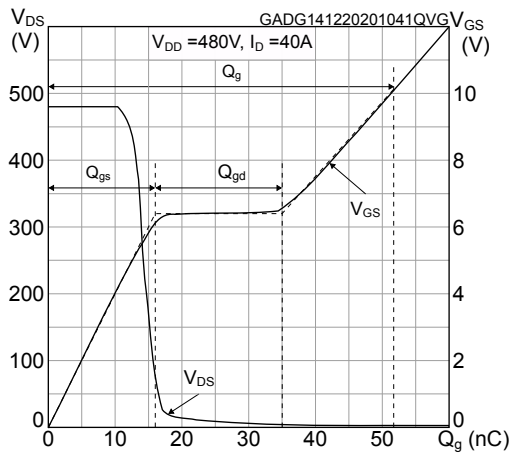
**Figure 3. Typical output characteristics**



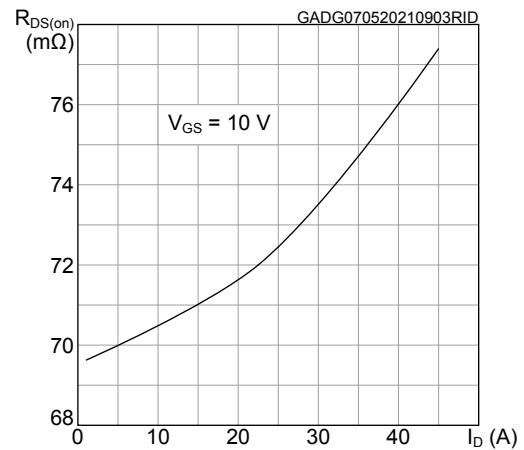
**Figure 4. Typical transfer characteristics**



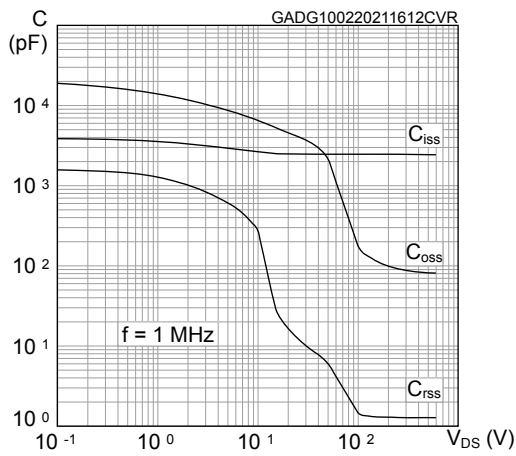
**Figure 5. Typical gate charge characteristics**



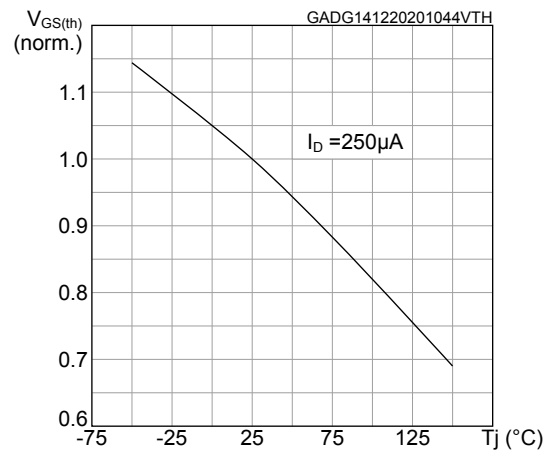
**Figure 6. Typical drain-source on-resistance**



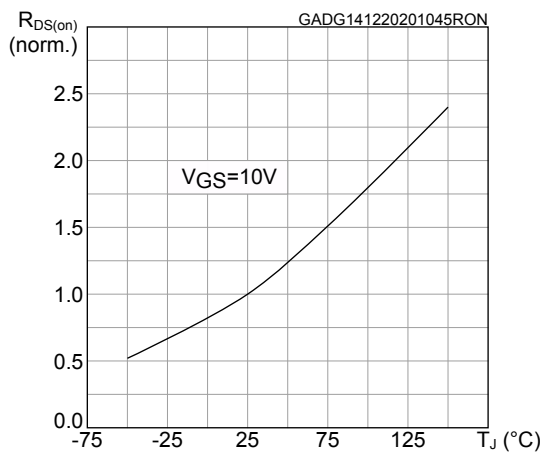
**Figure 7. Typical capacitance characteristics**



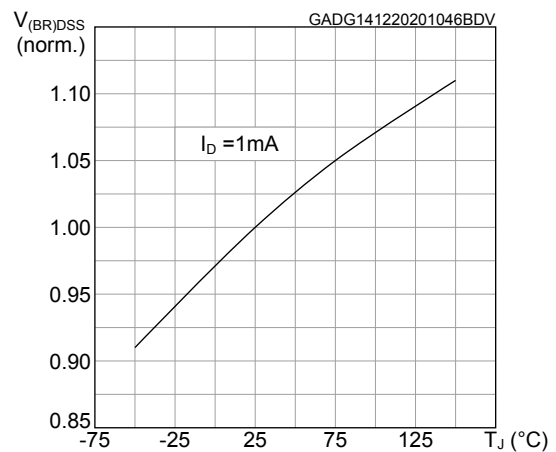
**Figure 8. Normalized gate threshold vs temperature**



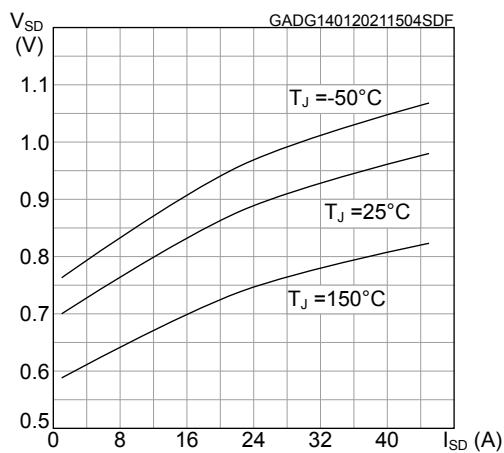
**Figure 9. Normalized on-resistance vs temperature**



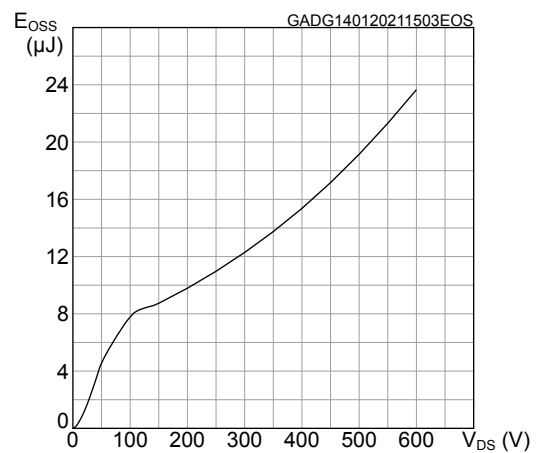
**Figure 10. Normalized breakdown voltage vs temperature**



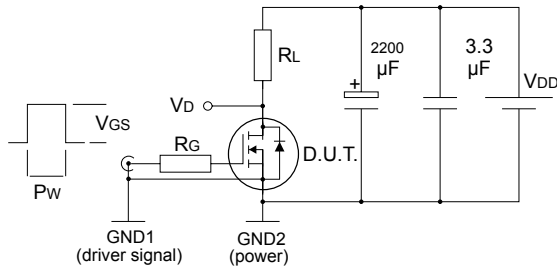
**Figure 11. Typical reverse diode forward characteristics**



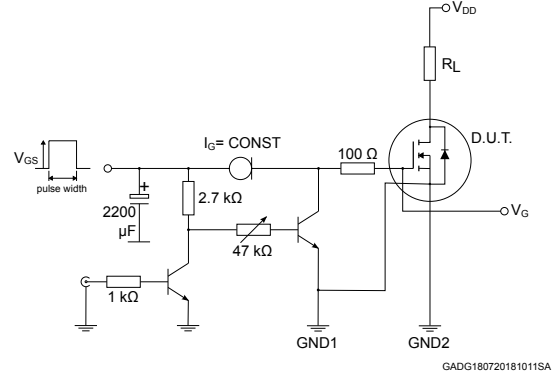
**Figure 12. Typical output capacitance stored energy**



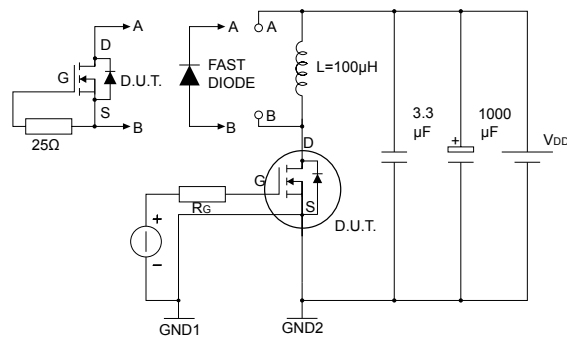
### 3 Test circuits

**Figure 13. Switching times test circuit for resistive load**


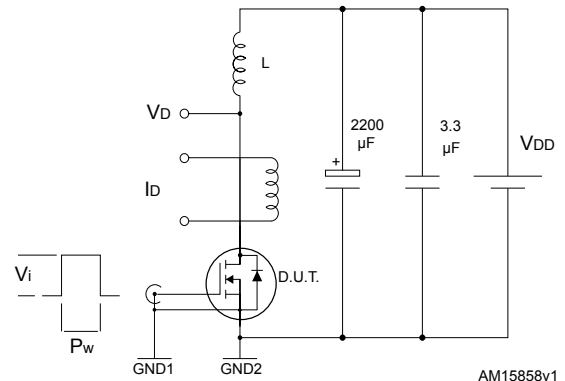
AM15855v1

**Figure 14. Test circuit for gate charge behavior**


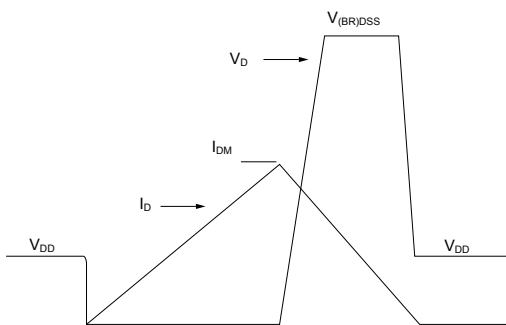
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**Figure 15. Test circuit for inductive load switching and diode recovery times**


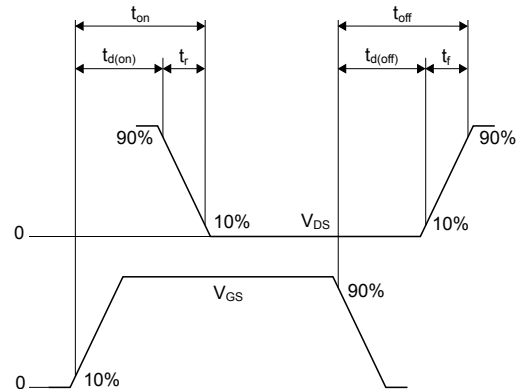
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**Figure 16. Unclamped inductive load test circuit**


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**Figure 17. Unclamped inductive waveform**


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**Figure 18. Switching time waveform**


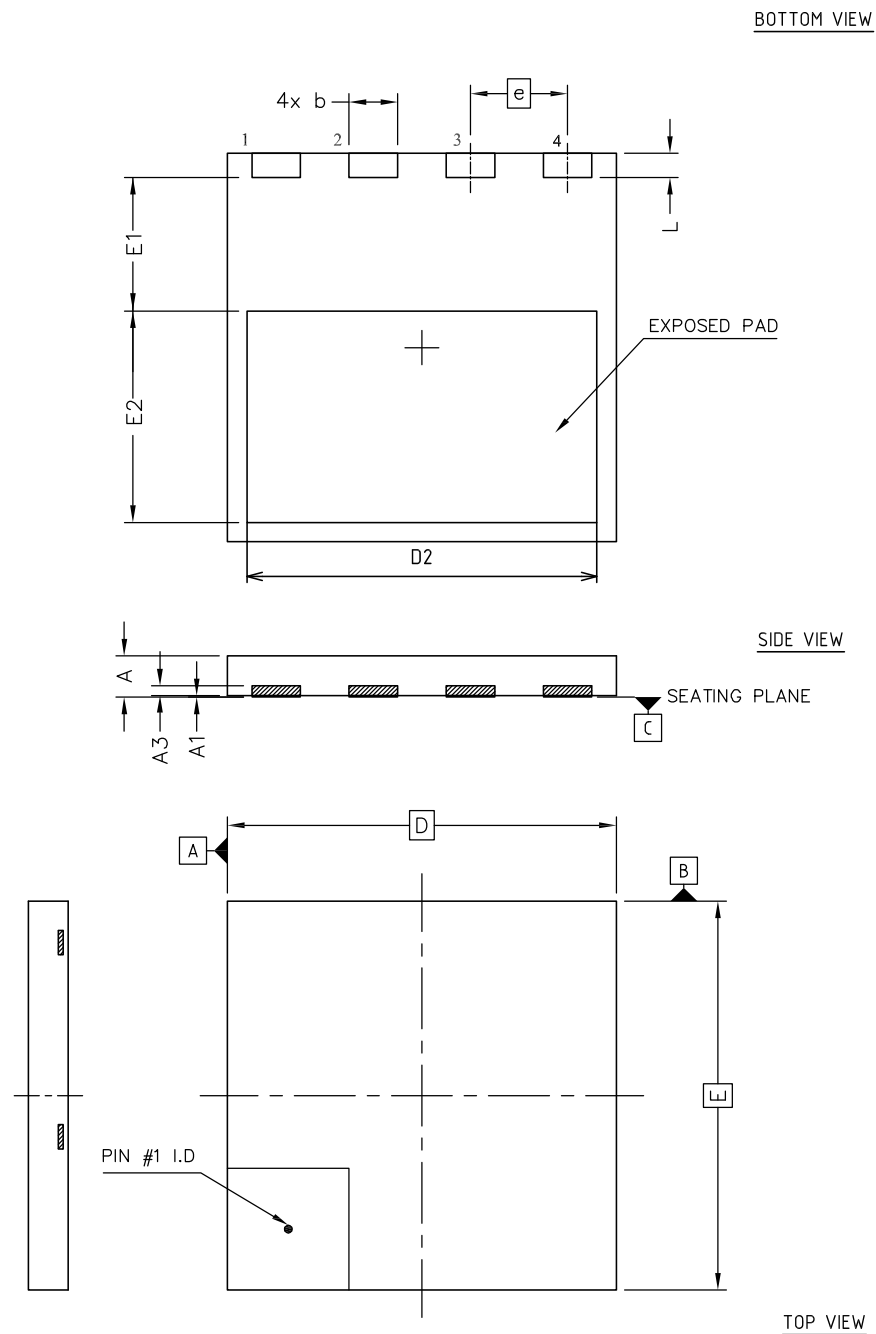
AM01473v1

## 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 type A package information

**Figure 19. PowerFLAT 8x8 HV type A package outline**



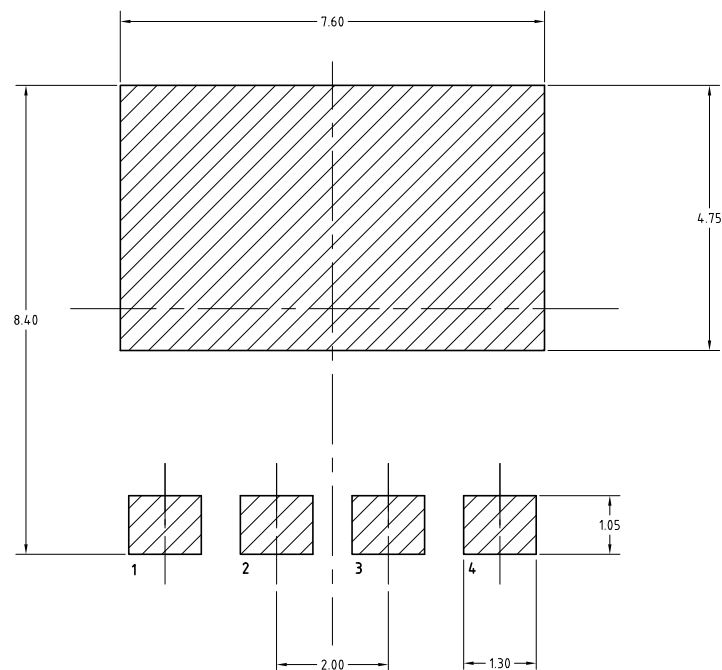
8222871\_Rev\_4



**Table 8. PowerFLAT 8x8 HV type A mechanical data**

Ref.	Dimensions (in 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 BSC		
L	0.40	0.50	0.60

**Figure 20. PowerFLAT 8x8 HV footprint**

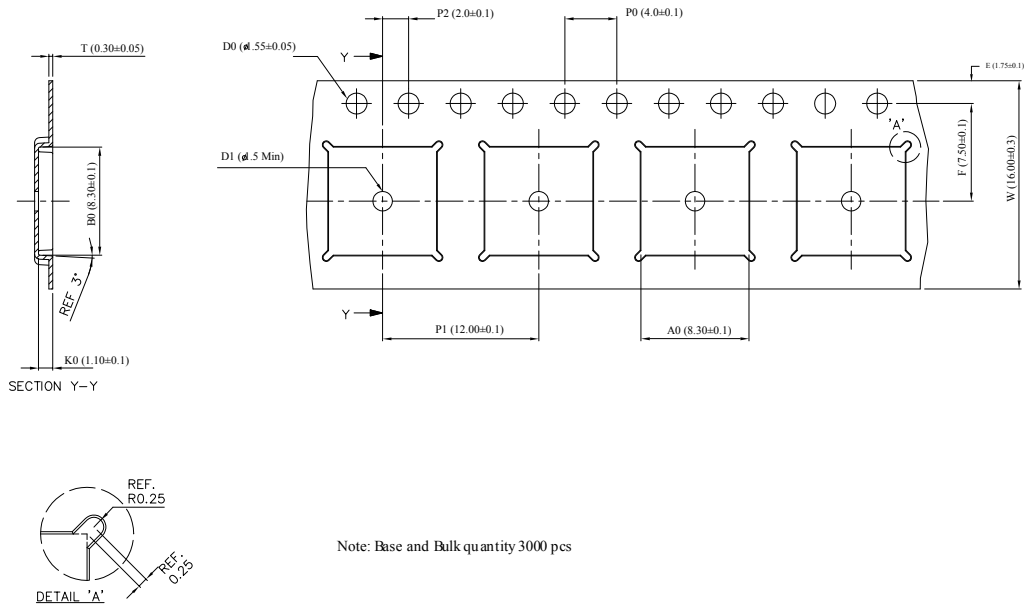


8222871\_REV\_4\_footprint

*Note:* All dimensions are in millimeters.

## 4.2 PowerFLAT 8x8 HV packing information

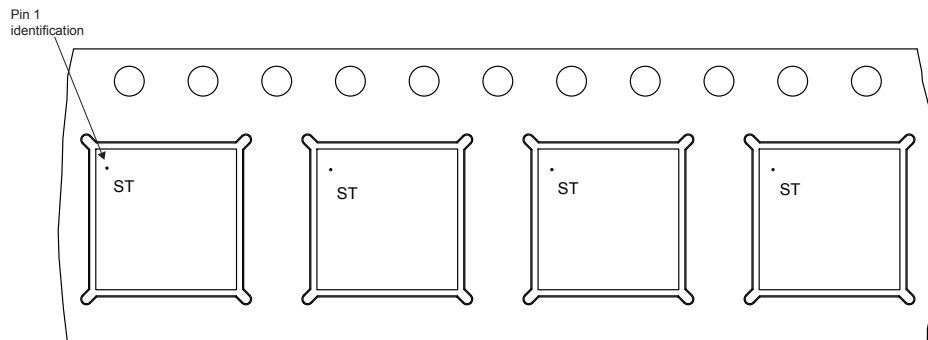
Figure 21. PowerFLAT 8x8 HV tape



8229819\_Tape\_revA

Note: All dimensions are in millimeters.

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





## Revision history

**Table 9. Document revision history**

Date	Revision	Changes
01-Apr-2019	1	First release.
05-May-2021	2	Modified <i>Table 1. Absolute maximum ratings</i> , <i>Table 2. Thermal data</i> , <i>Table 3. Avalanche characteristics</i> , <i>Table 4. On/off states</i> , <i>Table 5. Dynamic</i> , <i>Table 6. Switching times</i> and <i>Table 7. Source-drain diode</i> . Modified <i>Section 2.1 Electrical characteristics (curves)</i> . Minor text changes.
25-Jun-2021	3	Updated <i>Features</i> in cover page. Updated <i>Table 4. On/off states</i> . Updated <i>Figure 1. Safe operating area</i> .

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