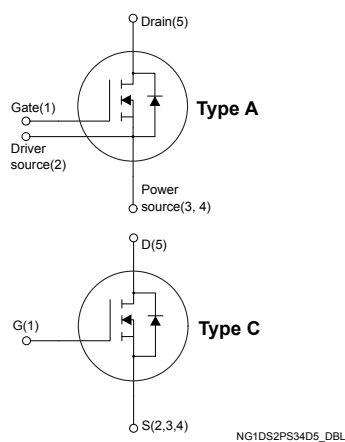
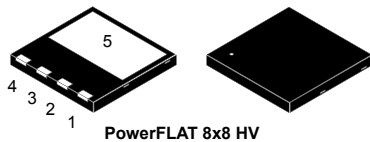


N-channel 650 V, 180 mΩ typ., 15 A, MDmesh M5 Power MOSFET in a PowerFLAT 8x8 HV package



Features

Order code	$V_{DS} @ T_{Jmax}$	$R_{DS(on)}$ max.	I_D
STL22N65M5	710 V	210 mΩ	15 A

- Extremely low $R_{DS(on)}$
- Low gate charge and input capacitance
- Excellent switching performance
- 100% avalanche tested

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET based on the MDmesh M5 innovative vertical process technology combined with the well-known PowerMESH horizontal layout. The resulting product offers extremely low on-resistance, making it particularly suitable for applications requiring high power and superior efficiency.



Product status link

[STL22N65M5](#)

Product summary

Order code	STL22N65M5
Marking	22N65M5
Package	PowerFLAT 8x8 HV
Packing	Tape and reel

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 25	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	15	A
	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	9.5	
$I_{DM}^{(1)}$	Drain current (pulsed)	60	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	110	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
T_{stg}	Storage temperature range	-55 to 150	$^{\circ}\text{C}$
T_J	Operating junction temperature range		

- Pulse width is limited by safe operating area.
- $I_{SD} \leq 15\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DS(peak)} < V_{(BR)DSS}$, $V_{DD} = 400\text{ V}$

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJA}	Thermal resistance, junction-to-case	1.14	$^{\circ}\text{C}/\text{W}$
$R_{thJB}^{(1)}$	Thermal resistance, junction-to-board	45	$^{\circ}\text{C}/\text{W}$

- When mounted on an 1-inch² FR-4, 2oz Cu board

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
$I_{AR}^{(1)}$	Avalanche current, repetitive or not repetitive	4	A
$E_{AS}^{(2)}$	Single pulse avalanche energy	270	mJ

- Pulse width limited by T_{jmax}
- Starting $T_J = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$

2 Electrical characteristics

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

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$, $I_{\text{D}} = 1\text{ mA}$	650			V
I_{DSS}	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 650\text{ V}$			1	μA
		$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 650\text{ V}$, $T_{\text{case}} = 125\text{ }^{\circ}\text{C}^{(1)}$			100	
I_{GSS}	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$, $V_{\text{GS}} = \pm 25\text{ V}$			± 100	nA
$V_{\text{GS(th)}}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 8.5\text{ A}$		180	210	m Ω

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

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{\text{DS}} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$	-	1434	-	pF
C_{oss}	Output capacitance		-	38	-	
C_{rss}	Reverse transfer capacitance		-	3.7	-	
$C_{\text{o(er)}}^{(1)}$	Equivalent output capacitance energy related	$V_{\text{DS}} = 0\text{ to }520\text{ V}$, $V_{\text{GS}} = 0\text{ V}$	-	35	-	pF
$C_{\text{o(tr)}}^{(2)}$	Equivalent output capacitance time related		-	118	-	
R_{G}	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	3.5	-	Ω
Q_{g}	Total gate charge	$V_{\text{DD}} = 520\text{ V}$, $I_{\text{D}} = 9\text{ A}$, $V_{\text{GS}} = 0\text{ to }10\text{ V}$ (see Figure 15. Test circuit for gate charge behavior)	-	36	-	nC
Q_{gs}	Gate-source charge		-	7.5	-	
Q_{gd}	Gate-drain charge		-	18	-	

1. $C_{\text{o(er)}}$ is a constant capacitance value that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

2. $C_{\text{o(tr)}}$ is a constant capacitance value that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d(v)}}$	Voltage delay time	$V_{\text{DD}} = 400\text{ V}$, $I_{\text{D}} = 12\text{ A}$, $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 16. Test circuit for inductive load switching and diode recovery times and Figure 19. Switching time waveform)	-	43	-	ns
$t_{\text{r(v)}}$	Voltage rise time		-	7.5	-	
$t_{\text{f(i)}}$	Current fall time		-	7.5	-	
$t_{\text{c(off)}}$	Crossing time		-	11.5	-	

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		15	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		60	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 15\text{ A}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 15\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 100\text{ V}$	-	272		ns
Q_{rr}	Reverse recovery charge		-	3.4		μC
I_{RRM}	Reverse recovery current	(see Figure 16. Test circuit for inductive load switching and diode recovery times)	-	25		A
t_{rr}	Reverse recovery time	$I_{SD} = 15\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 100\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$	-	336		ns
Q_{rr}	Reverse recovery charge		-	4.3		μC
I_{RRM}	Reverse recovery current	(see Figure 16. Test circuit for inductive load switching and diode recovery times)	-	25.6		A

1. Pulse width is limited by safe operating area.
2. Pulse test: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics curves

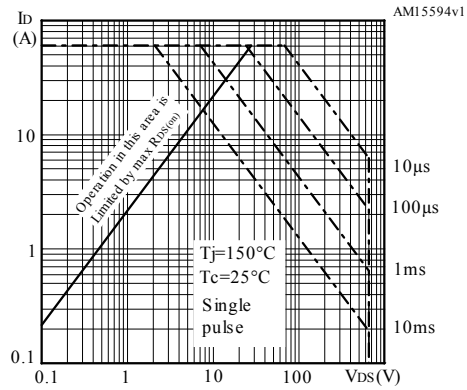
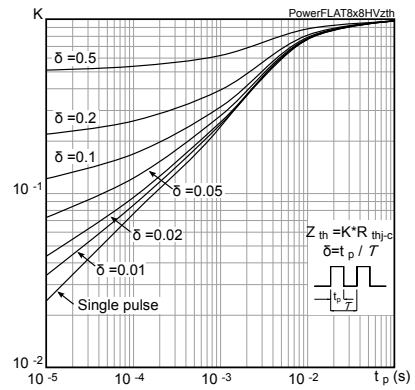
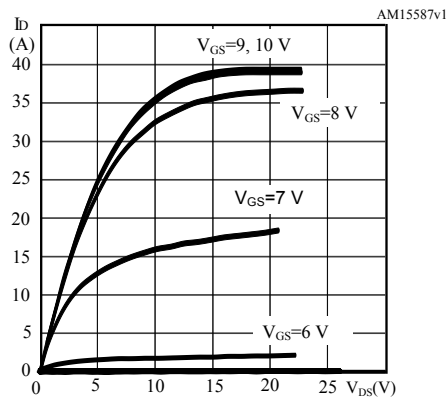
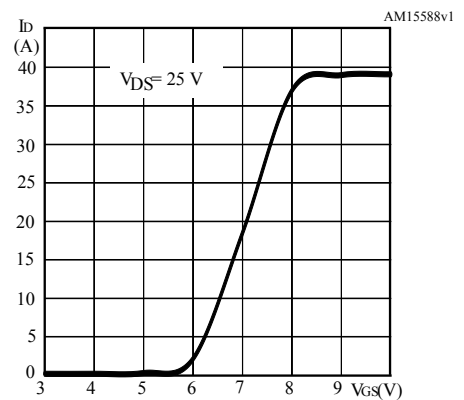
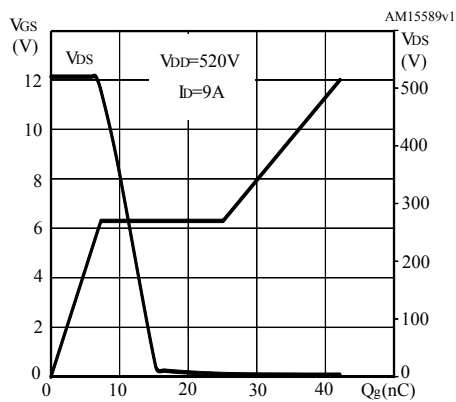
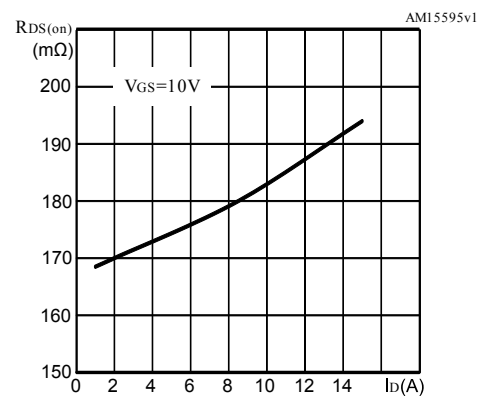
Figure 1. Safe operating area

Figure 2. Thermal impedance

Figure 3. Output characteristics

Figure 4. Transfer characteristics

Figure 5. Gate charge vs gate-source voltage

Figure 6. Static drain-source on-resistance


Figure 7. Capacitance variations

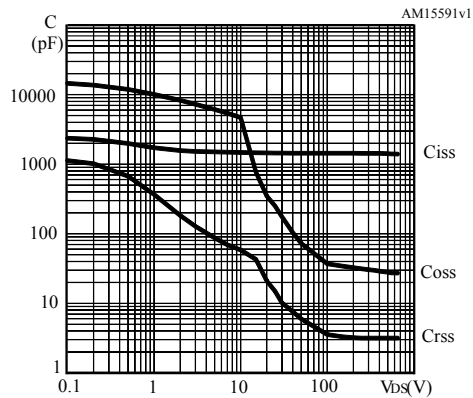


Figure 8. Output capacitance stored energy

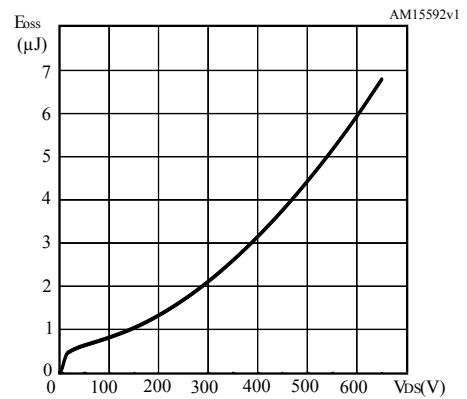


Figure 9. Normalized gate threshold voltage vs temperature

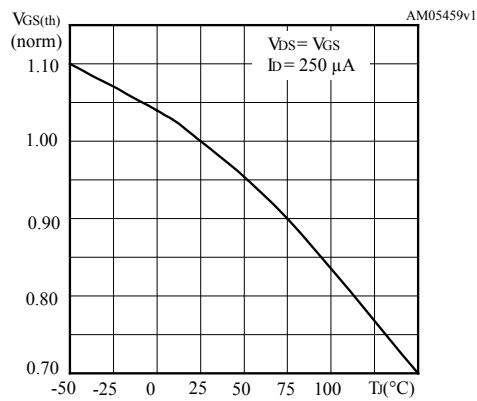


Figure 10. Normalized on-resistance vs temperature

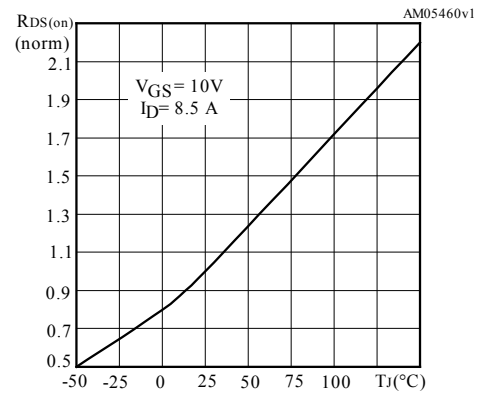


Figure 11. Normalized breakdown voltage vs temperature

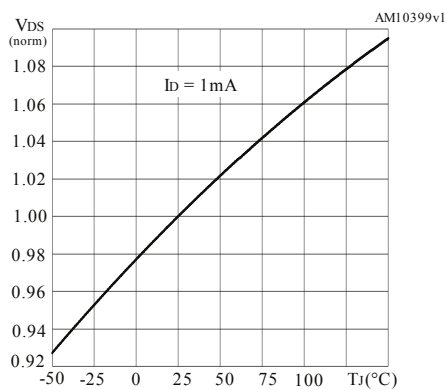


Figure 12. Drain-source diode forward characteristics

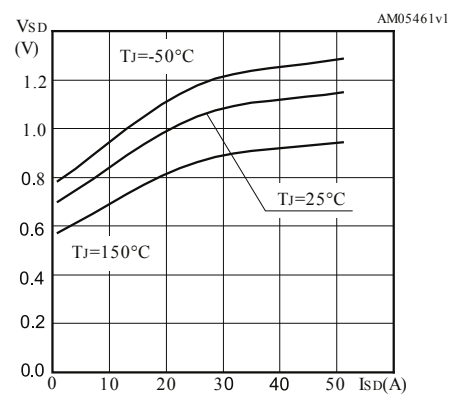
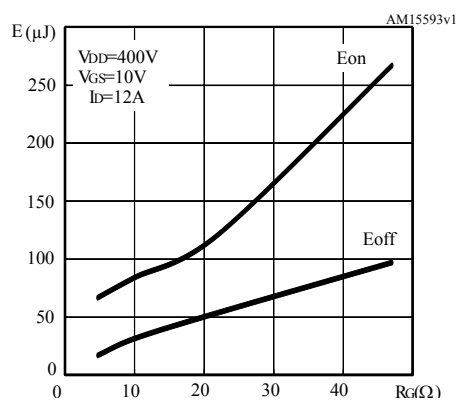
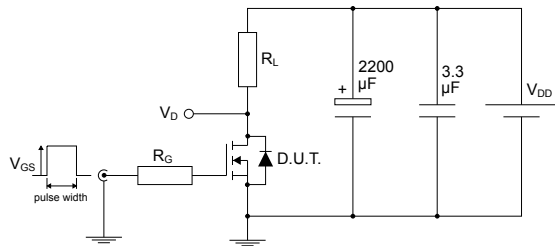


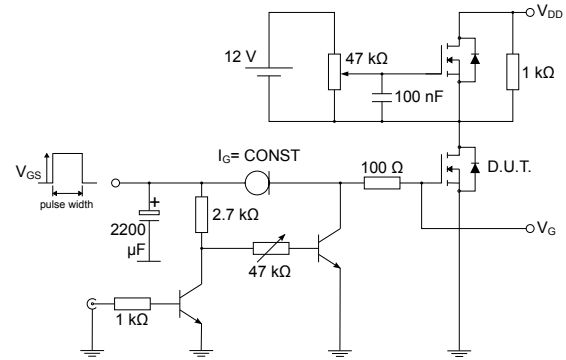
Figure 13. Switching energy vs gate resistance



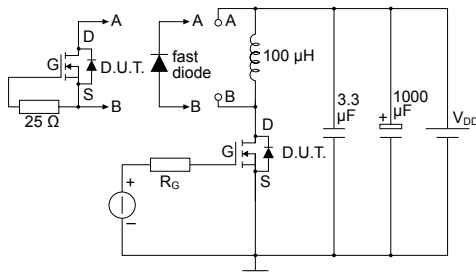
3 Test circuits

Figure 14. Test circuit for resistive load switching times


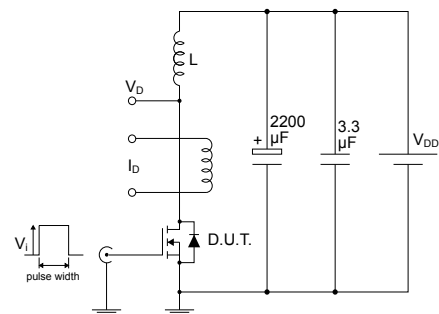
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Figure 15. Test circuit for gate charge behavior


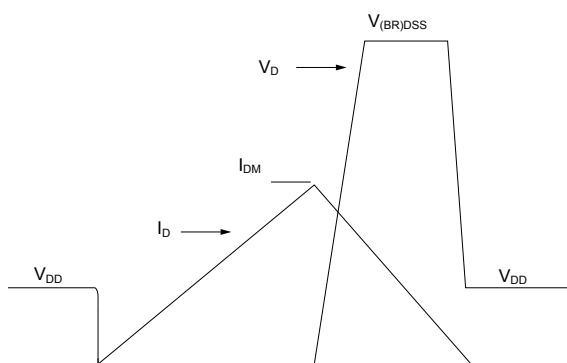
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Figure 16. Test circuit for inductive load switching and diode recovery times


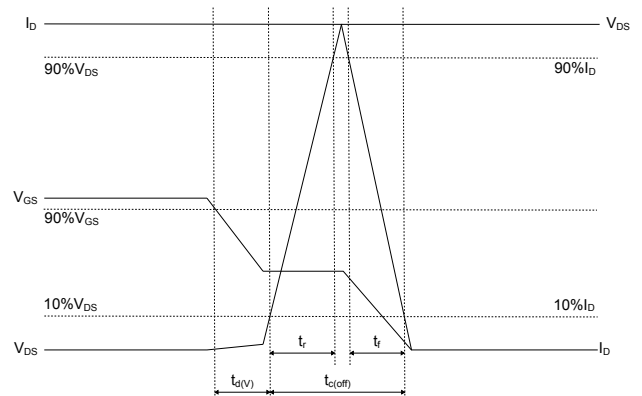
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Figure 17. Unclamped inductive load test circuit


AM01471v1

Figure 18. Unclamped inductive waveform


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Figure 19. Switching time waveform


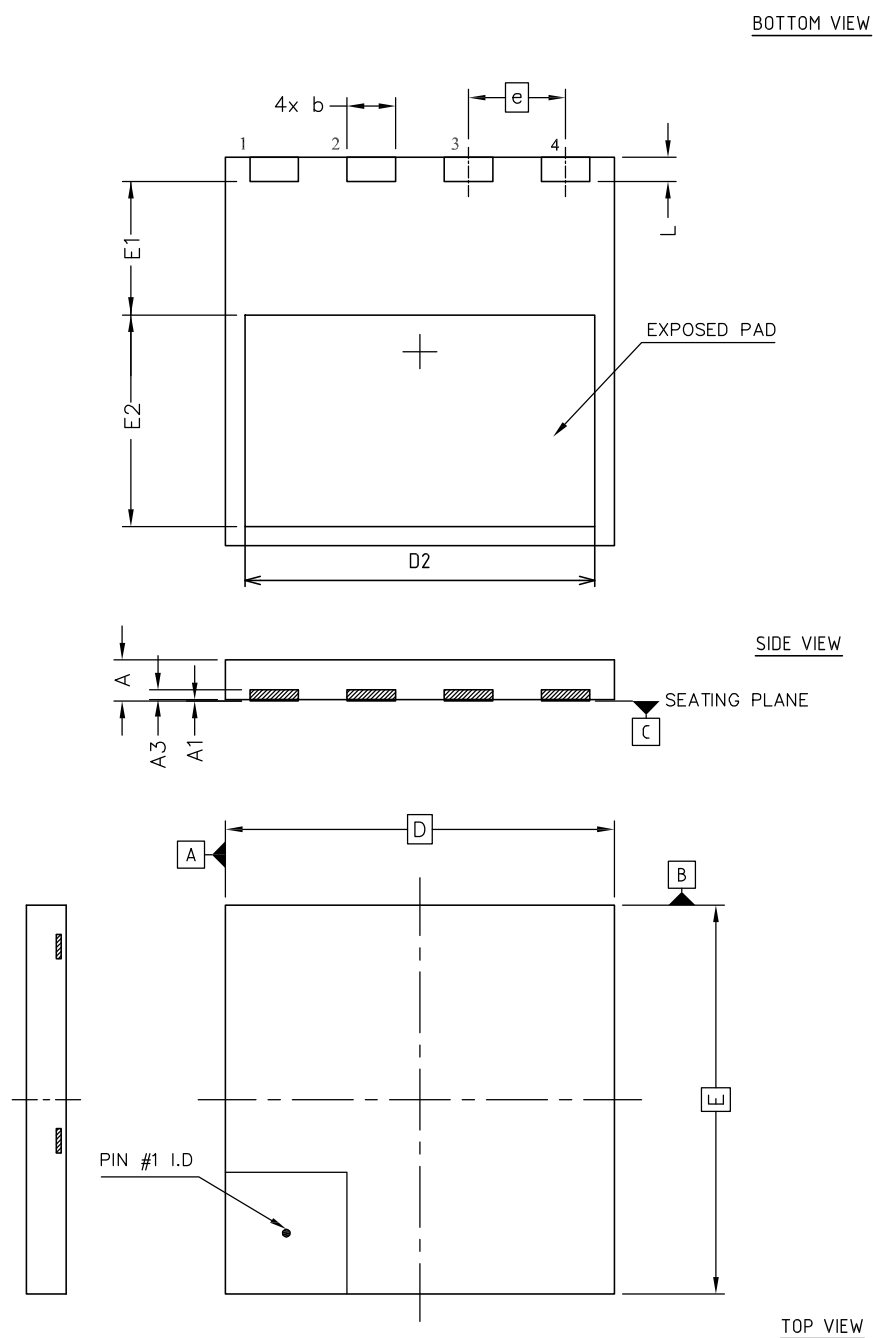
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4 Package information

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. ECOPACK is an ST trademark.

4.1 PowerFLAT 8x8 HV type A package information

Figure 20. PowerFLAT 8x8 HV type A package outline



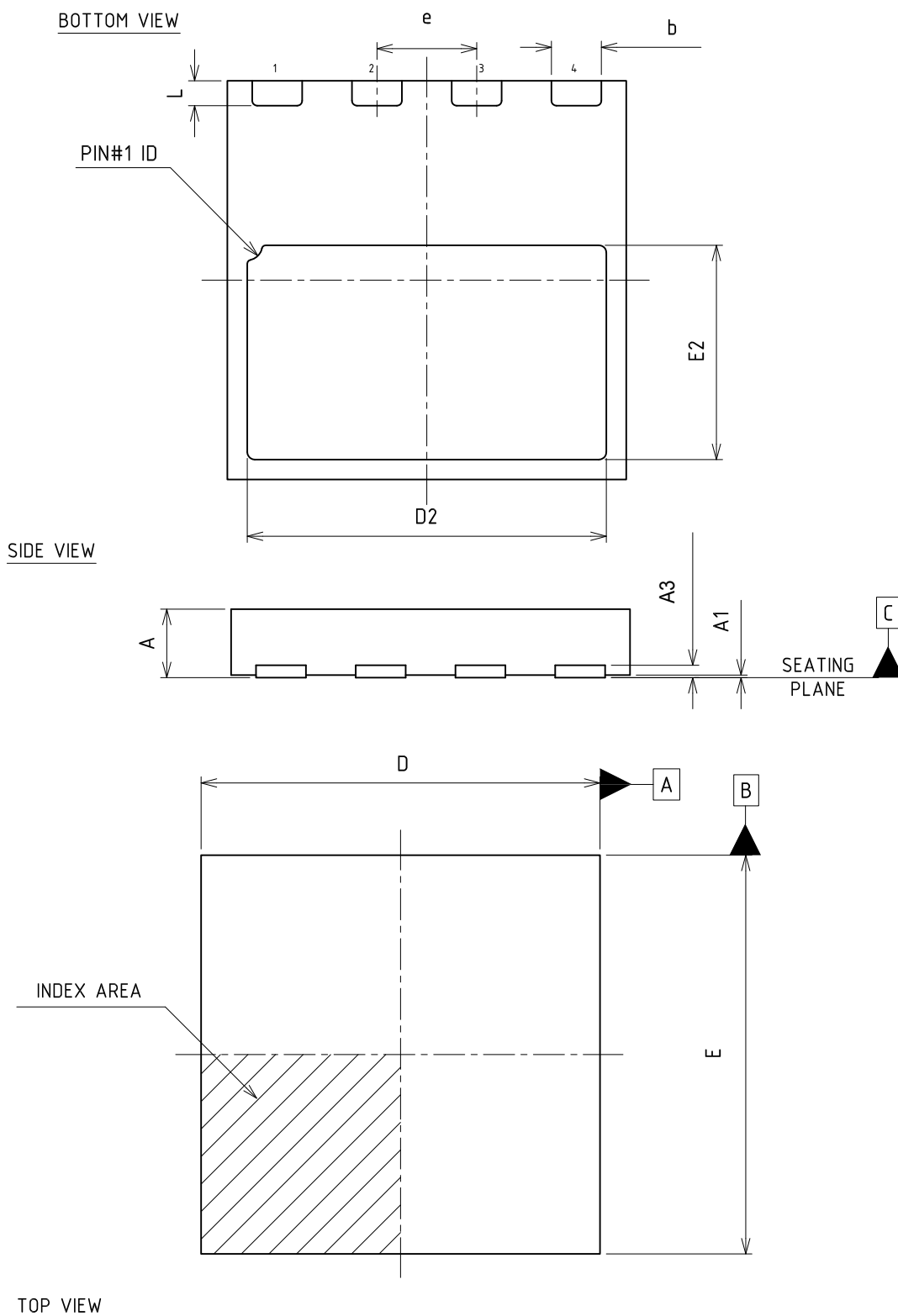
8222871_Rev_4

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

4.2 PowerFLAT 8x8 HV type C package information

Figure 21. PowerFLAT 8x8 HV type C package outline

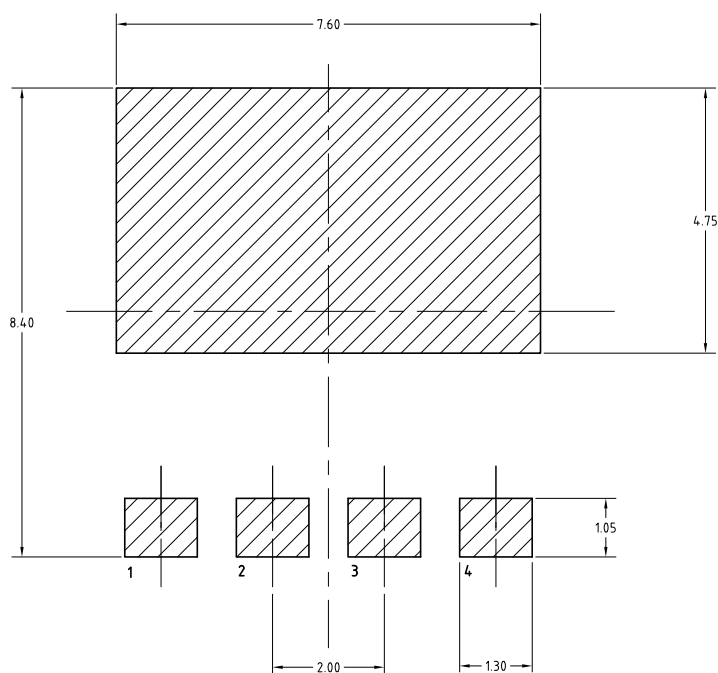


8222871_Rev4_typeC

Table 9. PowerFLAT 8x8 HV type C mechanical data

Ref.	Dimensions (in mm)		
	Min.	Typ.	Max.
A	0.80	0.90	1.00
A1	0.00	0.02	0.05
A3	0.10	0.20	0.30
b	0.95	1.00	1.05
D		8.00	
D2	7.05	7.20	7.30
E		8.00	
E2	4.15	4.30	4.40
e		2.00	
L	0.40	0.50	0.60

Figure 22. PowerFLAT 8x8 HV footprint

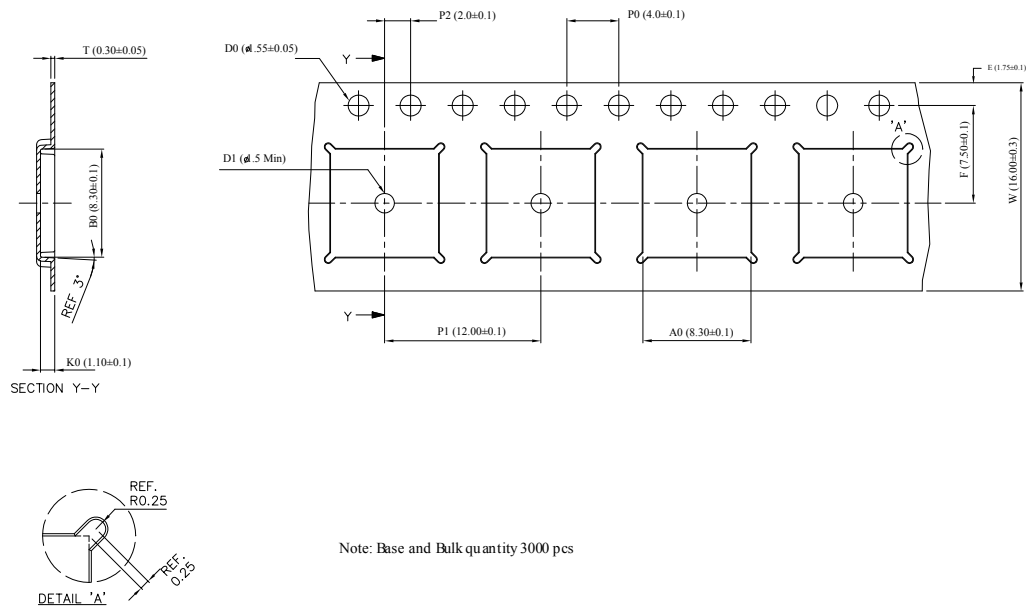


8222871_REV_4_footprint

Note: All dimensions are in millimeters.

4.3 PowerFLAT 8x8 HV packing information

Figure 23. PowerFLAT 8x8 HV tape



8229819_Tape_revA

Note: All dimensions are in millimeters.

Figure 24. PowerFLAT 8x8 HV package orientation in carrier tape

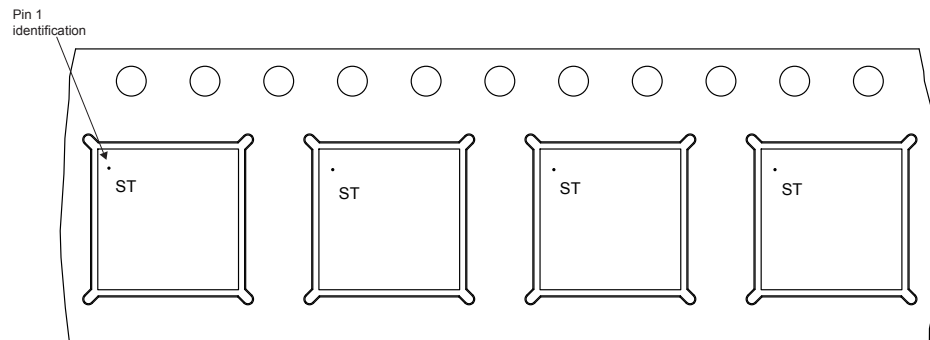
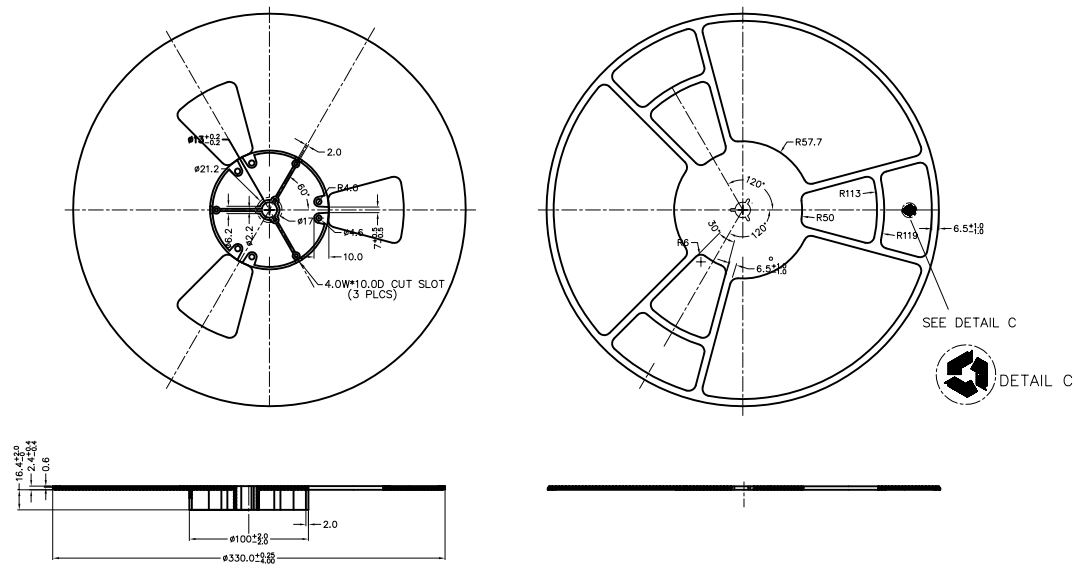


Figure 25. PowerFLAT 8x8 HV reel



8229819_Reel_revA

Note: All dimensions are in millimeters.

Revision history

Table 10. Document revision history

Date	Version	Changes
06-Aug-2012	1	First release.
01-Feb-2013	2	– Document status promoted from preliminary data to production data – Modified: <i>Figure 1</i>, IDM, IAR, dv/dt values on <i>Table 2</i>, note 4, RDS(on) value on <i>Table 4</i>, typical values on <i>Table 5</i>, 6 and 7 and ISDM max value on <i>Table 7</i> – Inserted: <i>Section 2.1: Electrical characteristics (curves)</i> – Minor text changes
21-Oct-2020	3	Modified title, description and internal schematic diagram in cover page. Updated <i>Section 1 Electrical ratings</i> and <i>Section 2 Electrical characteristics</i> . Added <i>Section 4.2 PowerFLAT 8x8 HV type C package information</i> . Minor text changes.
16-Feb-2021	4	Modified Figure 24. PowerFLAT 8x8 HV package orientation in carrier tape . Minor text changes.

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