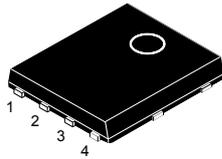
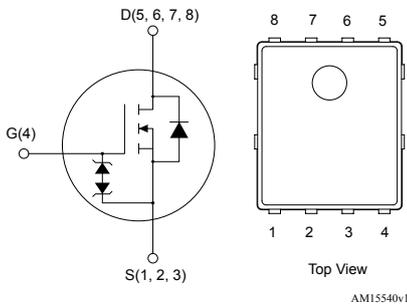


N-channel 650 V, 0.85 Ω typ., 4.5 A MDmesh M2 Power MOSFET in a PowerFLAT 5x6 HV package


PowerFLAT 5x6 HV


Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STL10N65M2	650 V	1.00 Ω	4.5 A

- Extremely low gate charge
- Excellent output capacitance (C_{OSS}) 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.



Product status link

[STL10N65M2](#)

Product summary

Order code	STL10N65M2
Marking	10N65M2
Package	PowerFLAT 5x6 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 $T_C = 25\text{ }^\circ\text{C}$	4.5	A
	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	2.8	A
$I_{DM}^{(1)}$	Drain current pulsed	18	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ }^\circ\text{C}$	48	W
I_{AR}	Avalanche current, repetitive or non-repetitive (pulse width limited by T_J max)	0.9	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	95	mJ
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
$dv/dt^{(3)}$	MOSFET dv/dt ruggedness	50	
T_J	Operating junction temperature range	-55 to 150	$^\circ\text{C}$
T_{stg}	Storage temperature range		

1. Pulse width is limited by safe operating area.
2. $I_{SD} \leq 4.5\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DS(peak)} \leq V_{(BR)DSS}$, $V_{DD} = 400\text{ V}$.
3. $V_{DS} \leq 520\text{ V}$.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	2.6	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	50	$^\circ\text{C}/\text{W}$

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

2 Electrical characteristics

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

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	650			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 650\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 650\text{ V}$, $T_C = 125\text{ °C}$ ⁽¹⁾			100	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 25\text{ V}$			± 10	μA
$V_{GS(th)}$	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	$V_{GS} = 10\text{ V}$, $I_D = 2.5\text{ A}$		0.85	1.00	Ω

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

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	310	-	pF
C_{oss}	Output capacitance		-	18	-	pF
C_{riss}	Reverse transfer capacitance		-	0.9	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent capacitance energy related	$V_{DS} = 0\text{ to }520\text{ V}$, $V_{GS} = 0\text{ V}$	-	109	-	pF
R_g	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	6.6	-	Ω
Q_g	Total gate charge	$V_{DD} = 520\text{ V}$, $I_D = 5\text{ A}$	-	10.3	-	nC
Q_{gs}	Gate-source charge	$V_{GS} = 0\text{ to }10\text{ V}$	-	2.4	-	nC
Q_{gd}	Gate-drain charge	(see Figure 14. Test circuit for gate charge behavior)	-	4.8	-	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 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 325\text{ V}$, $I_D = 2.5\text{ A}$,	-	7.5	-	ns
t_r	Rise time	$R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$	-	6.6	-	ns
$t_{d(off)}$	Turn-off delay time	(see Figure 13. Test circuit for resistive load switching times and	-	22.5	-	ns
t_f	Fall time	Figure 18. Switching time waveform)	-	18	-	ns

Table 6. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		4.5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		18	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 4.5 \text{ A}$, $V_{GS} = 0 \text{ V}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 5 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$,	-	276		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 60 \text{ V}$	-	1.7		μC
I_{RRM}	Reverse recovery current	(see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	12.5		A
t_{rr}	Reverse recovery time	$I_{SD} = 5 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$,	-	312		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 60 \text{ V}$, $T_J = 150 \text{ }^\circ\text{C}$	-	1.9		μC
I_{RRM}	Reverse recovery current	(see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	12.4		A

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

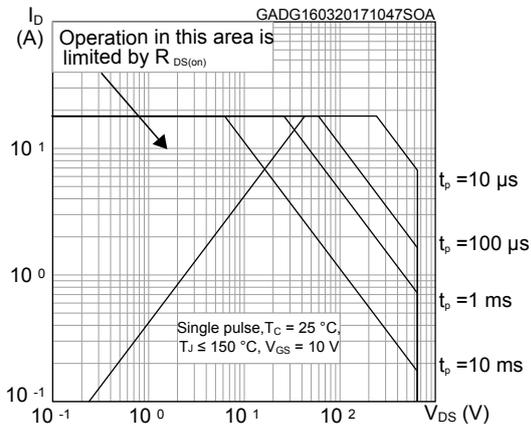


Figure 2. Thermal impedance

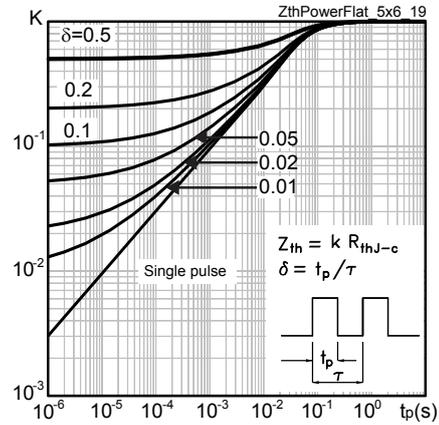


Figure 3. Output characteristics

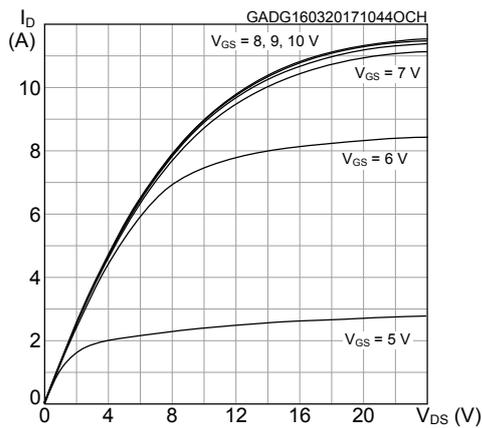


Figure 4. Transfer characteristics

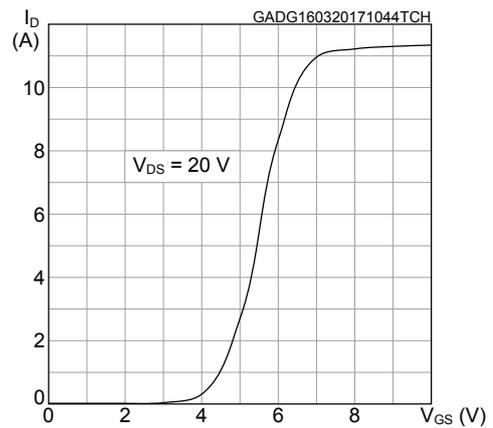


Figure 5. Gate charge vs gate-source voltage

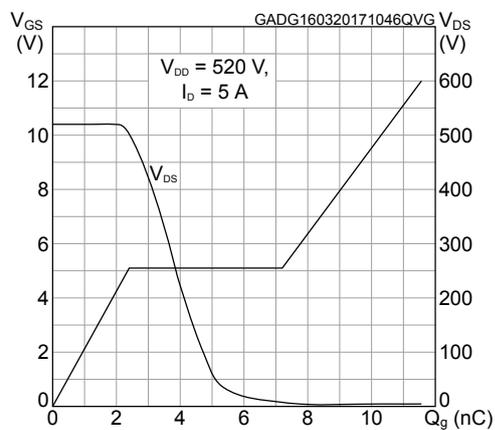


Figure 6. Static drain-source on-resistance

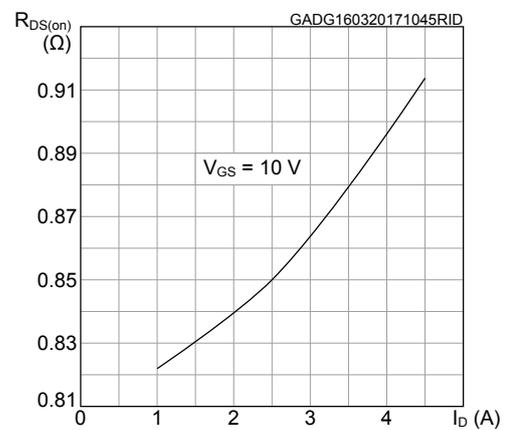


Figure 7. Capacitance variations

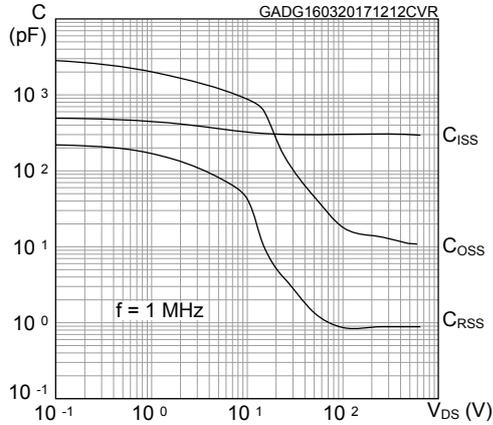


Figure 8. Output capacitance stored energy

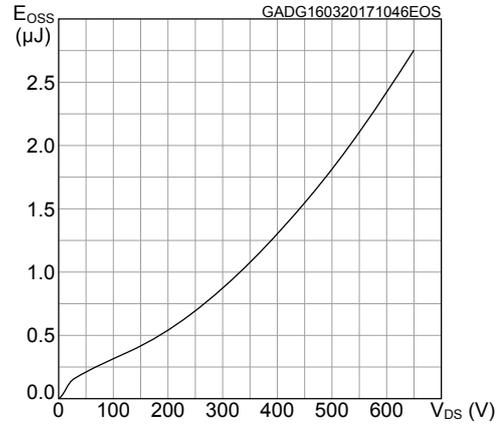


Figure 9. Normalized gate threshold voltage vs temperature

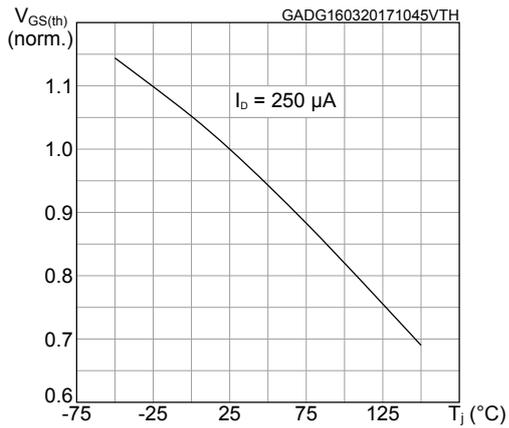


Figure 10. Normalized on-resistance vs temperature

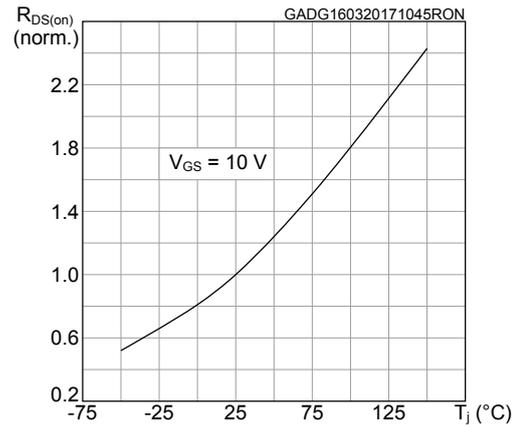


Figure 11. Normalized $V_{(BR)DSS}$ vs temperature

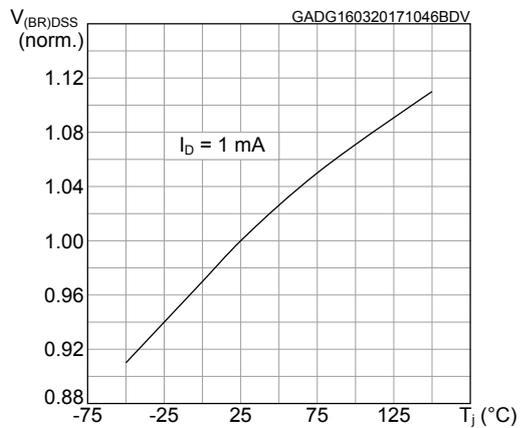
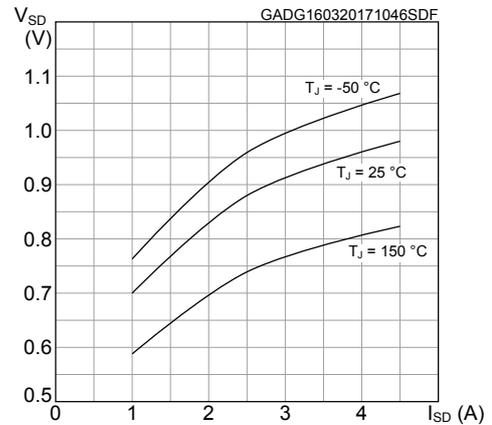
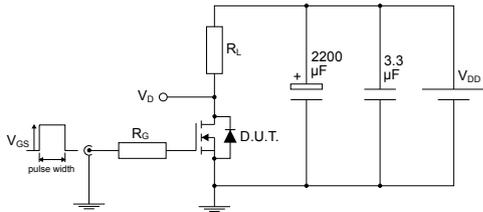


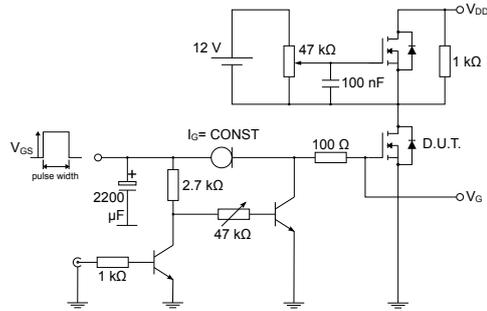
Figure 12. Source-drain diode forward characteristics



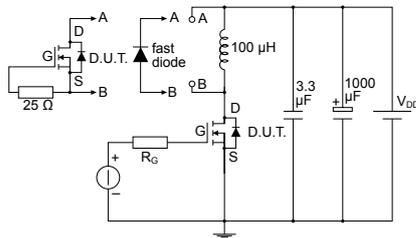
3 Test circuits

Figure 13. Test circuit for resistive load switching times


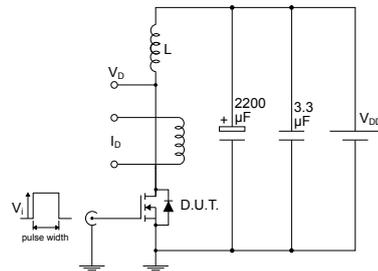
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Figure 14. Test circuit for gate charge behavior


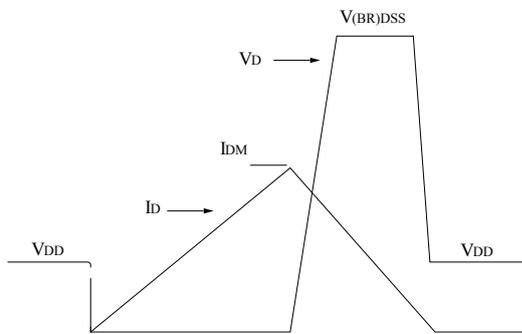
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Figure 15. Test circuit for inductive load switching and diode recovery times


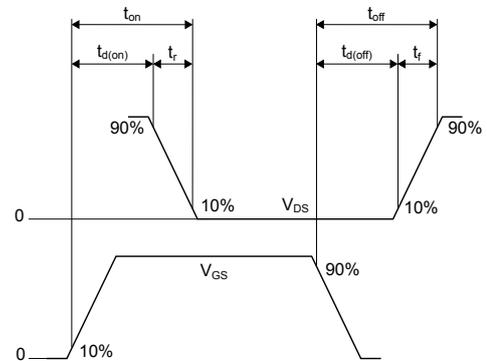
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Figure 16. Unclamped inductive load test circuit


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Figure 17. Unclamped inductive waveform


AM01472v1

Figure 18. Switching time waveform


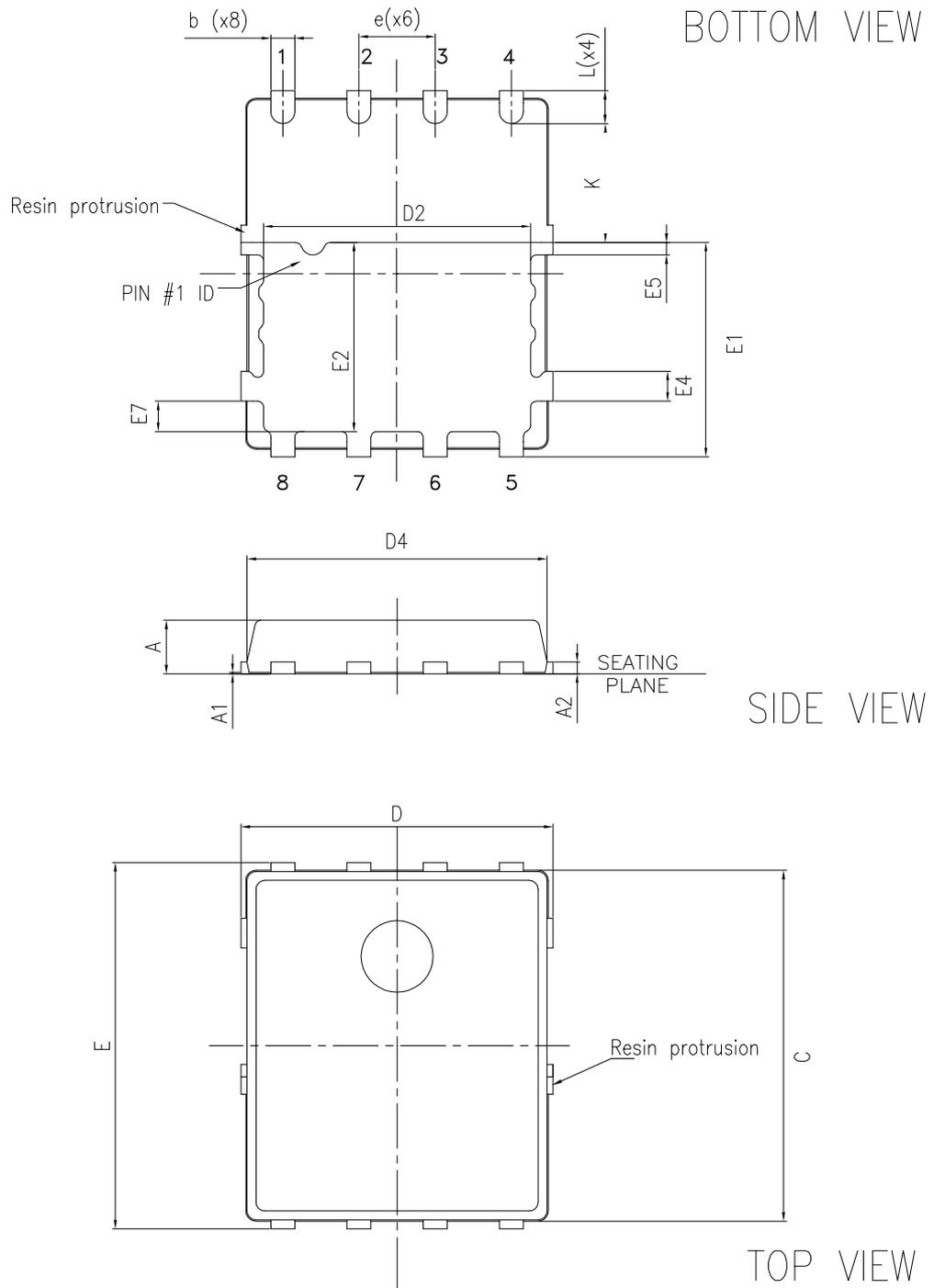
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4 Package information

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 5x6 HV package information

Figure 19. PowerFLAT 5x6 HV package outline

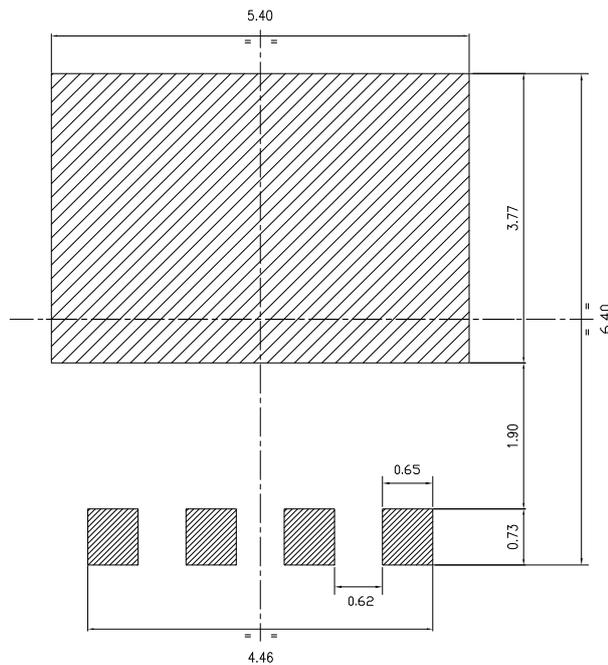


8368143_Rev_4

Table 7. PowerFLAT 5x6 HV mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
C	5.60	5.80	6.00
D	5.10	5.20	5.30
D2	4.30	4.40	4.50
D4	4.60	4.80	5.00
E	6.05	6.15	6.25
E1	3.50	3.60	3.70
E2	3.10	3.20	3.30
E4	0.40	0.50	0.60
E5	0.10	0.20	0.30
E7	0.40	0.50	0.60
e		1.27	
L	0.50	0.55	0.60
K	1.90	2.00	2.10

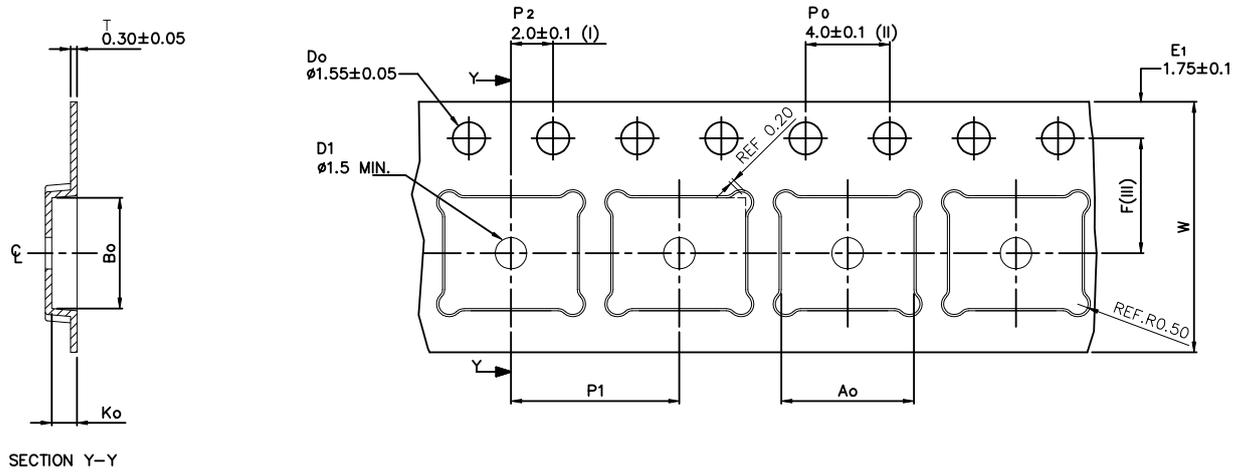
Figure 20. PowerFLAT™ 5x6 HV recommended footprint (dimensions are in mm)



8368143_Rev_4_footprint

4.2 PowerFLAT 5x6 packing information

Figure 21. PowerFLAT 5x6 tape (dimensions are in mm)



A ₀	6.30 +/- 0.1
B ₀	5.30 +/- 0.1
K ₀	1.20 +/- 0.1
F	5.50 +/- 0.1
P ₁	8.00 +/- 0.1
W	12.00 +/- 0.3

(I) Measured from centreline of sprocket hole to centreline of pocket.

(II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .

(III) Measured from centreline of sprocket hole to centreline of pocket

Base and bulk quantity 3000 pcs
All dimensions are in millimeters

8234350_Tape_rev_C

Figure 22. PowerFLAT 5x6 package orientation in carrier tape

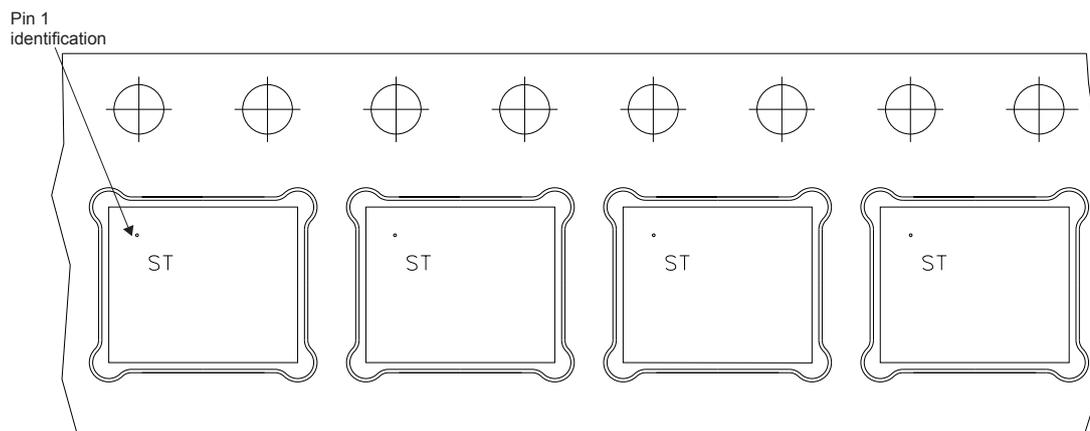
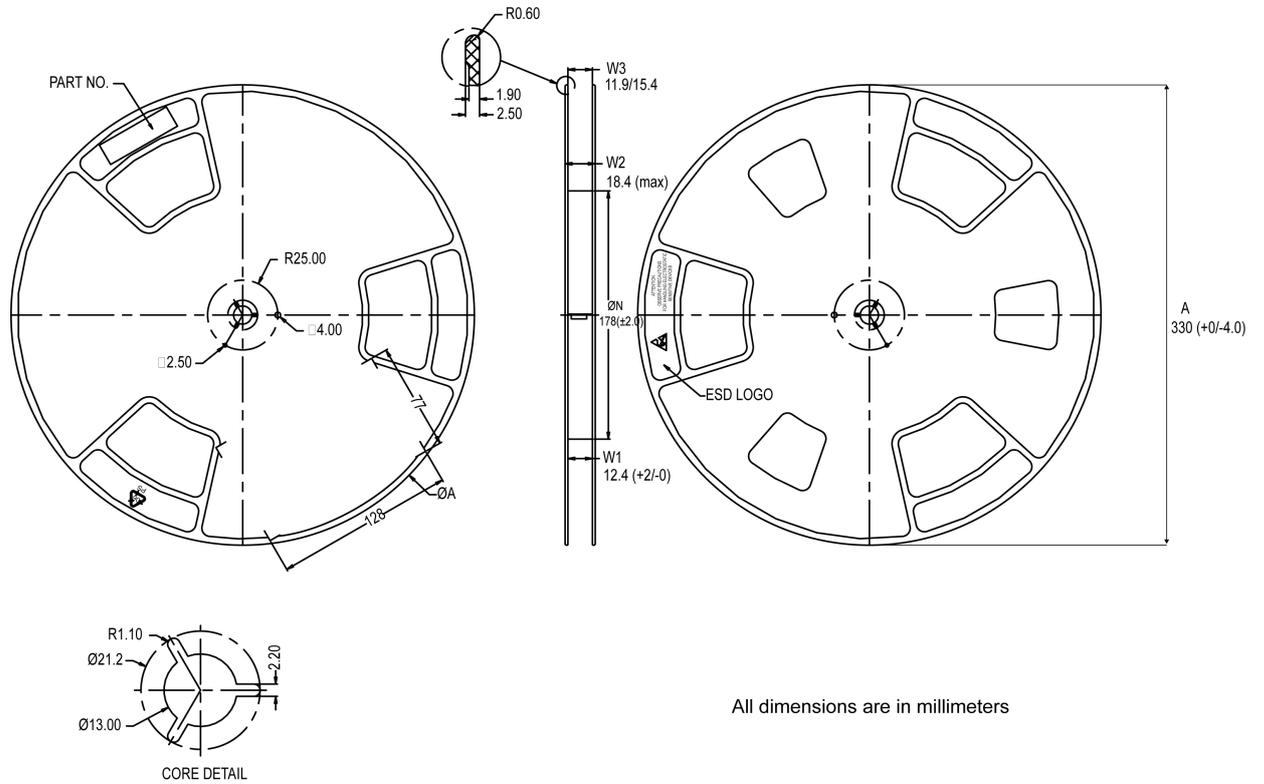


Figure 23. PowerFLAT 5x6 reel



All dimensions are in millimeters

8234350_Reel_rev_C

Revision history

Table 8. Document revision history

Date	Revision	Changes
16-Mar-2017	1	First release
20-Jun-2019	2	Removed maturity status indication from cover page. The document status is production data. Updated Table 1. Absolute maximum ratings and Table 4. Dynamic . Minor text changes.

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