

N-channel 600 V, 0.92 Ω typ., 5 A MDmesh™ M2 Power MOSFET in a PowerFLAT™ 5x5 package

Datasheet - production data

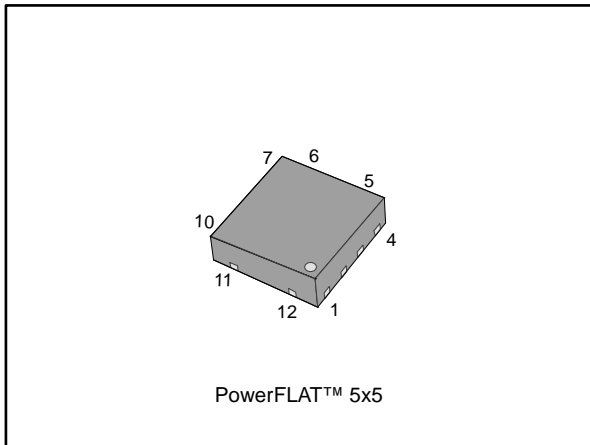
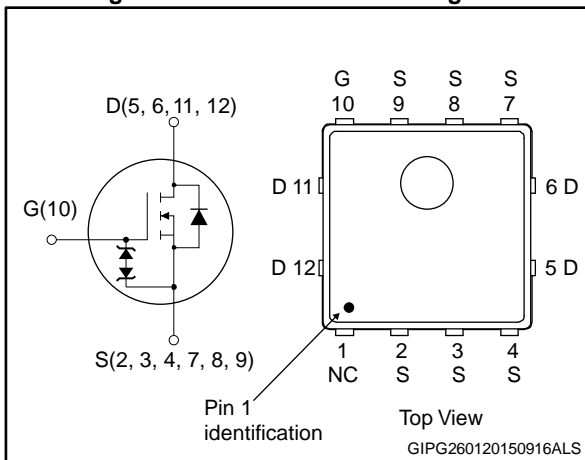


Figure 1: Internal schematic diagram



Features

Order code	V_{DS} @ T_{jmax}	$R_{DS(on)}$ max	I_D
STL7N60M2	650 V	1.05 Ω	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.

Table 1: Device summary

Order code	Marking	Package	Packaging
STL7N60M2	7N60M2	PowerFLAT 5x5	Tape and reel

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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	Drain current (continuous) at $T_C = 25\text{ °C}$	5	A
I_D	Drain current (continuous) at $T_C = 100\text{ °C}$	3.2	A
$I_{DM}^{(1)}$	Drain current (pulsed)	20	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25\text{ °C}$	1.2	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 100\text{ °C}$	0.8	A
$I_{DM}^{(1)(2)}$	Drain current (pulsed)	4.8	A
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	67	W
$P_{TOT}^{(2)}$	Total dissipation at $T_{pcb} = 25\text{ °C}$	4	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	- 55 to 150	°C
T_j	Max. operating junction temperature	150	°C

Notes:

⁽¹⁾Pulse width limited by safe operating area.

⁽²⁾When mounted on FR-4 Board of 1 inch², 2 oz Cu ($t < 10\text{ s}$)

⁽³⁾ $I_{SD} \leq 5\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$; $V_{DS\text{ peak}} < V_{(BR)DSS}$, $V_{DD} = 400\text{ V}$.

⁽⁴⁾ $V_{DS} \leq 480\text{ V}$

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.83	°C/W
$R_{thj-pcb}$	Thermal resistance junction-pcb max	31.3	°C/W

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	1	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$; $V_{DD} = 50\text{ V}$)	80	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	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 600\text{ V}$, $T_C = 125\text{ °C}$			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	$V_{GS} = 10\text{ V}$, $I_D = 2\text{ A}$		0.92	1.05	Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ISS}	Input capacitance	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	271	-	pF
C_{OSS}	Output capacitance		-	15.7	-	pF
C_{RSS}	Reverse transfer capacitance		-	0.68	-	pF
$C_{OSS\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }480\text{ V}$, $V_{GS} = 0\text{ V}$	-	75.5	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	7.2	-	Ω
Q_g	Total gate charge	$V_{DD} = 480\text{ V}$, $I_D = 5\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 15: "Gate charge test circuit")	-	8.8	-	nC
Q_{gs}	Gate-source charge		-	1.8	-	nC
Q_{gd}	Gate-drain charge		-	4.3	-	nC

Notes:

⁽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 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$, $I_D = 2.5\text{ A}$ $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 14: "Switching times test circuit for resistive load" and Figure 19: "Switching time waveform")	-	7.6	-	ns
t_r	Rise time		-	7.2	-	ns
$t_{d(off)}$	Turn-off-delay time		-	19.3	-	ns
t_f	Fall time		-	15.9	-	ns

Table 8: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		20	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 5\text{ A}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$ (see Figure 19 : "Switching time waveform")	-	275		ns
Q_{rr}	Reverse recovery charge		-	1.55		μC
I_{RRM}	Reverse recovery current		-	11		A
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 19 : "Switching time waveform")	-	376		ns
Q_{rr}	Reverse recovery charge		-	2.1		μC
I_{RRM}	Reverse recovery current		-	11		A

Notes:

⁽¹⁾ Pulse width is limited by safe operating area

⁽²⁾ Pulsed: pulse duration = 300 μs , duty cycle 1.5%

2.2 Electrical characteristics (curves)

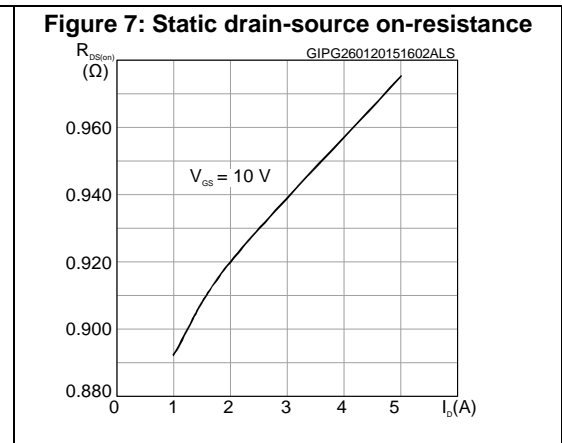
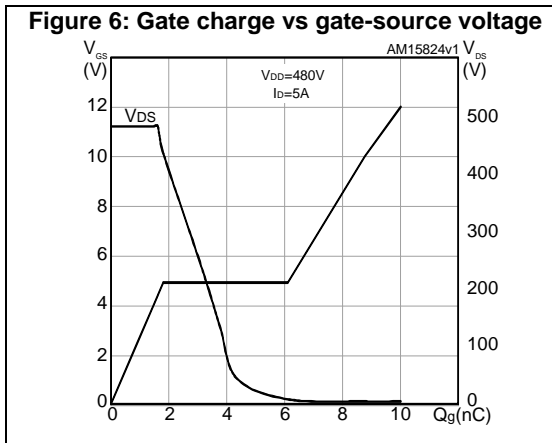
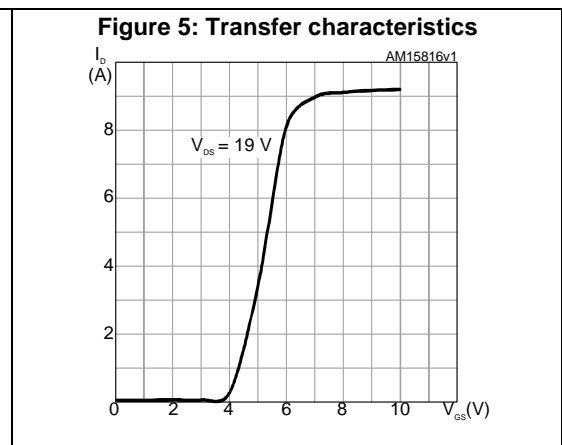
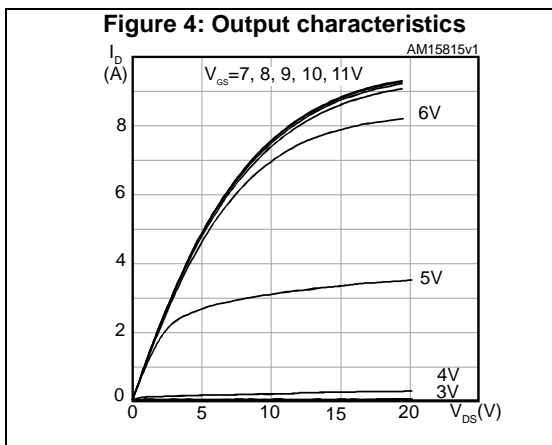
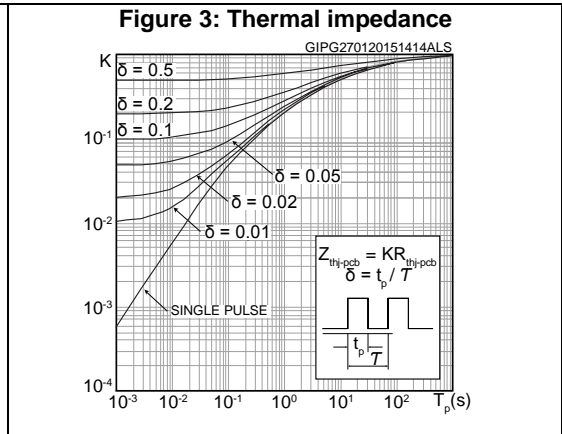
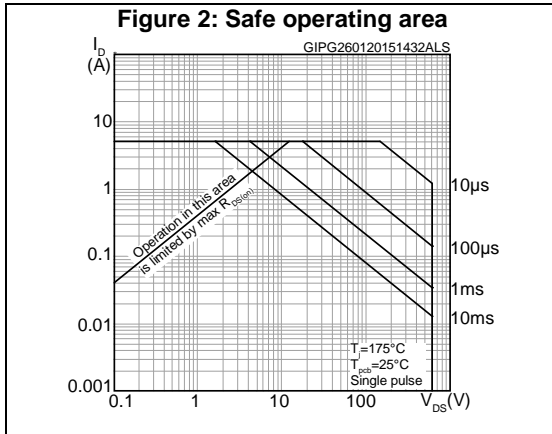


Figure 8: Capacitance variations

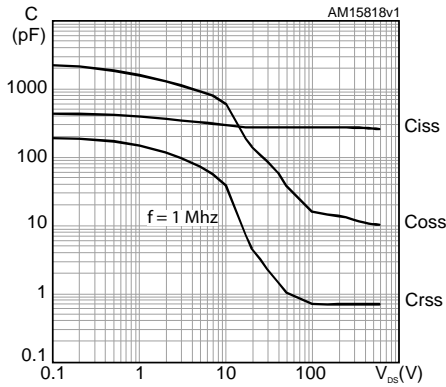


Figure 9: Output capacitance stored energy

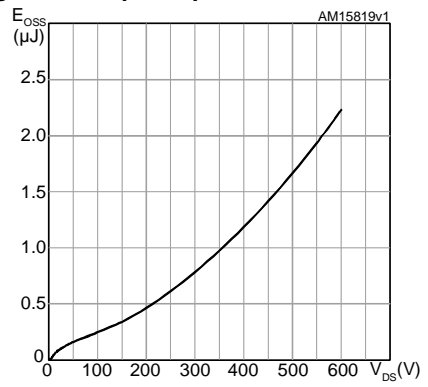


Figure 10: Normalized gate threshold voltage vs temperature

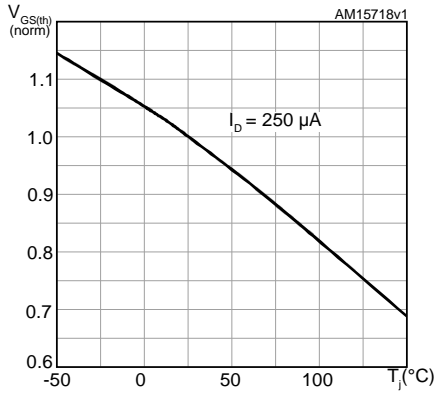


Figure 11: Normalized on-resistance vs temperature

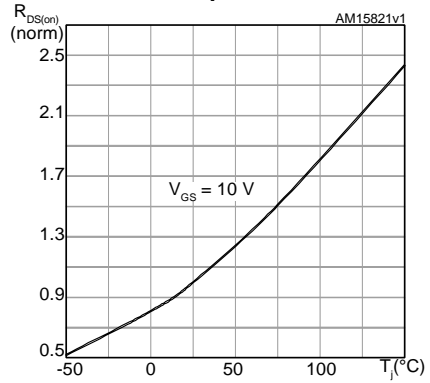


Figure 12: Source-drain diode forward characteristics

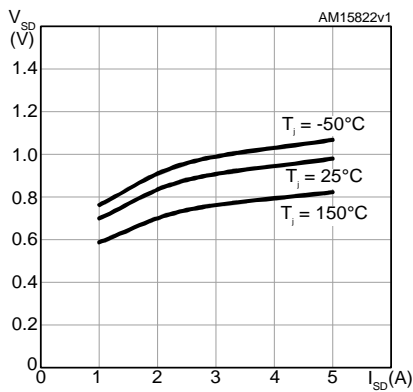
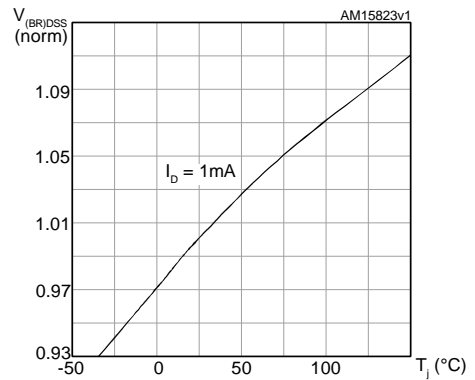
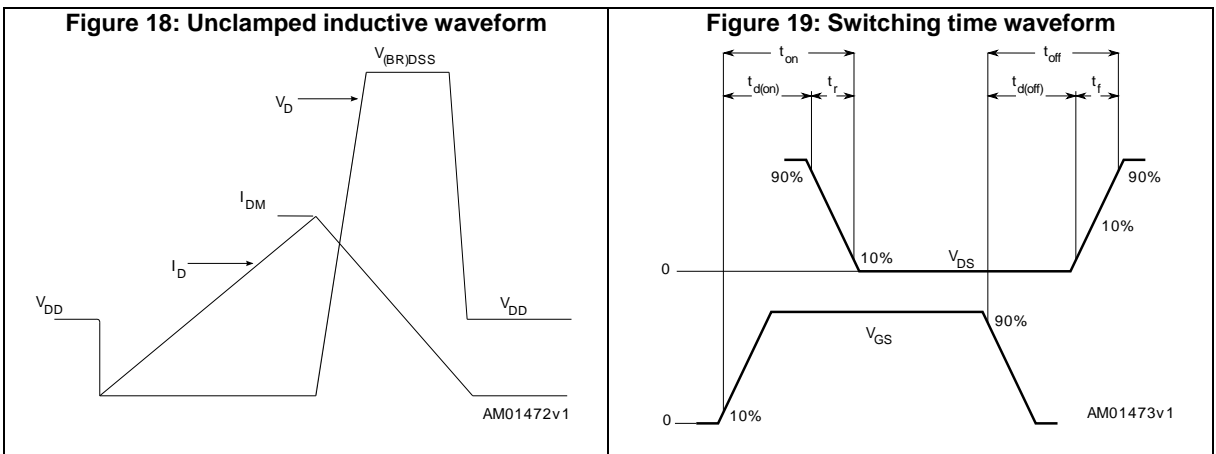
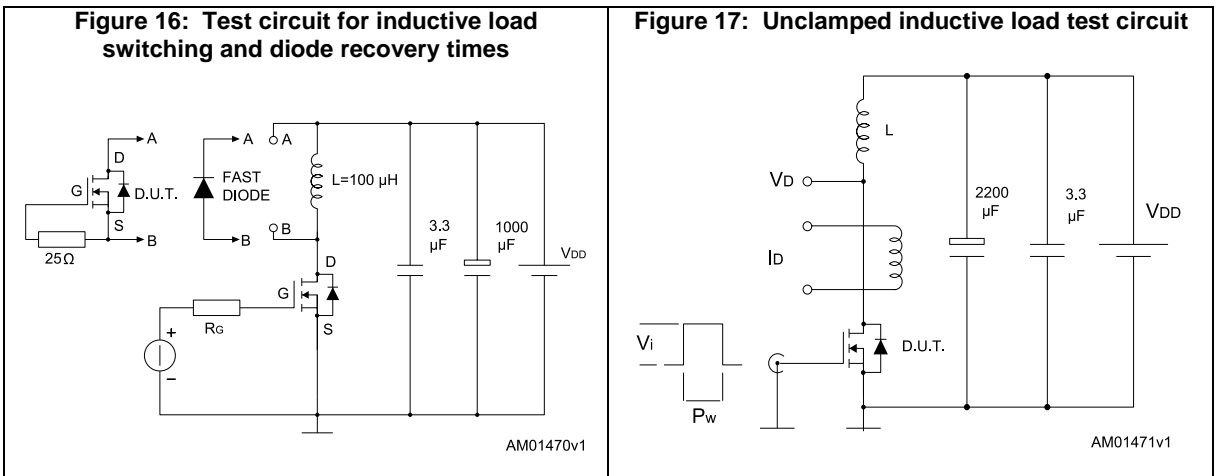
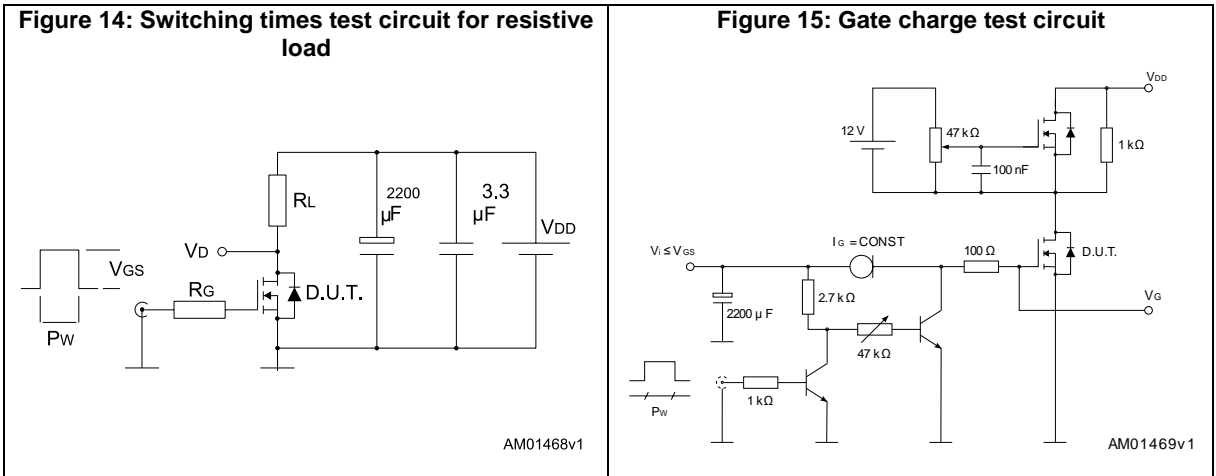


Figure 13: Normalized V(BR)DSS vs temperature



3 Test circuits

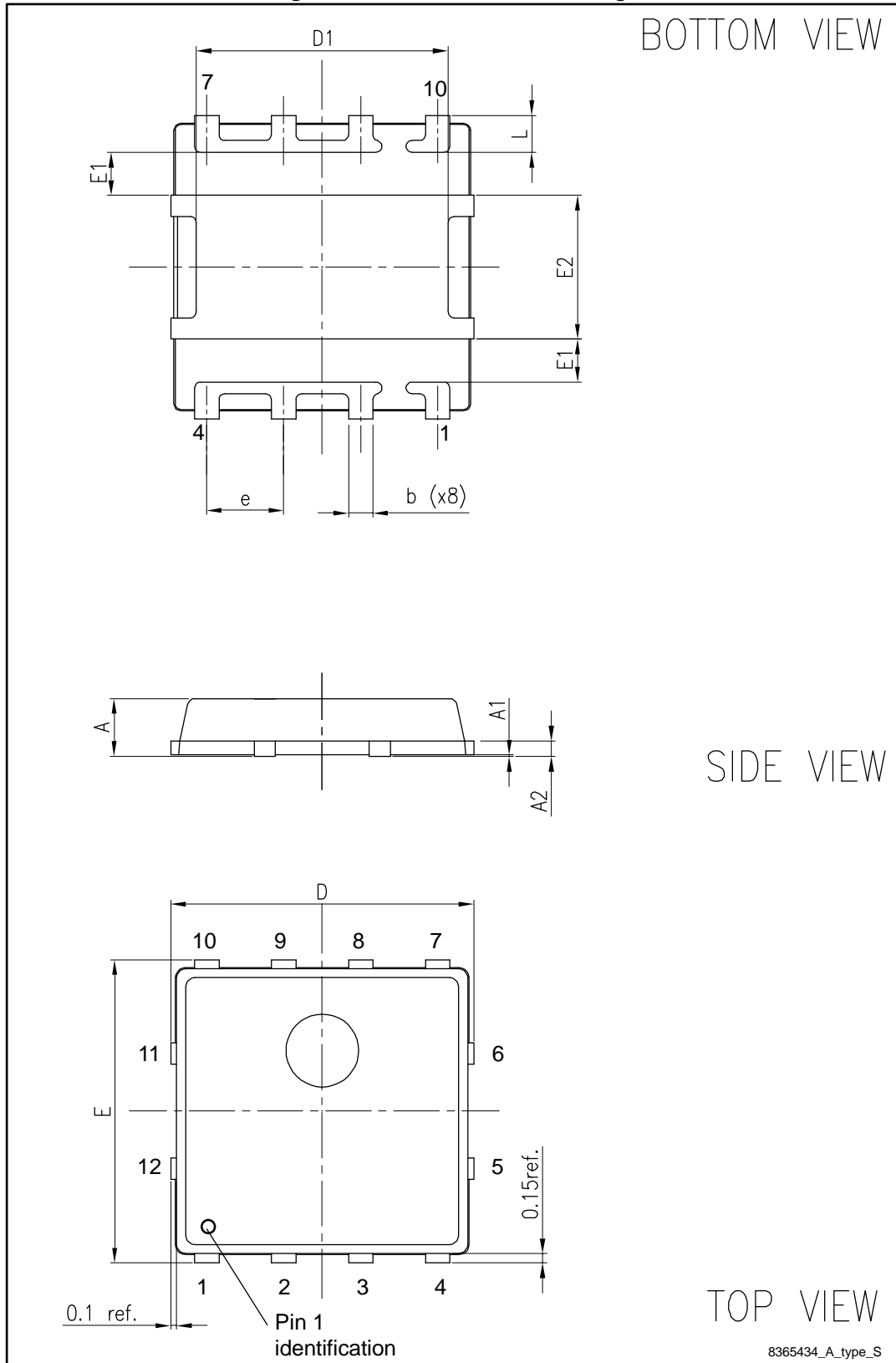


4 Package mechanical data

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 Package mechanical data

Figure 20: PowerFLAT™ 5x5 drawings

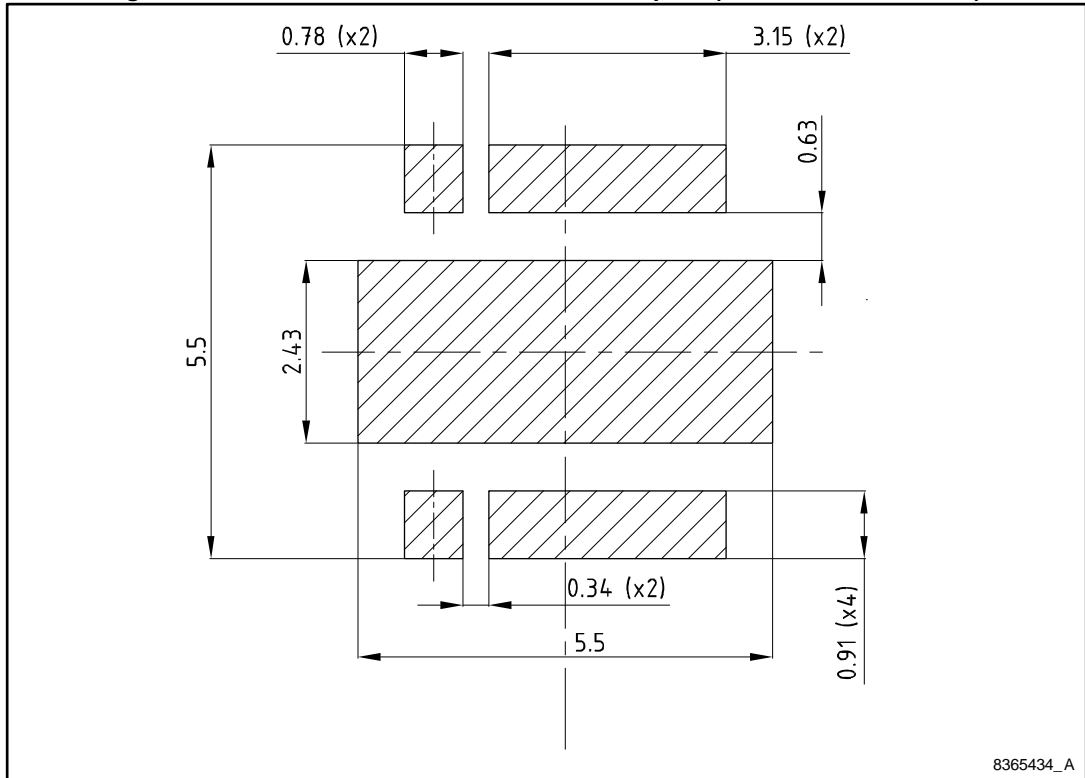


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Table 9: PowerFLAT 5x5 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.0
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
D		5.00	
D1	4.05		4.25
E		5.00	
E1	0.64		0.79
E2	2.25		2.45
e		1.27	
L	0.45		0.75

Figure 21: PowerFLAT™ 5x5 recommended footprint (dimensions are in mm)



5 Revision history

Table 10: Document revision history

Date	Revision	Changes
26-Jan-2015	1	First release.

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