STL11N65M5

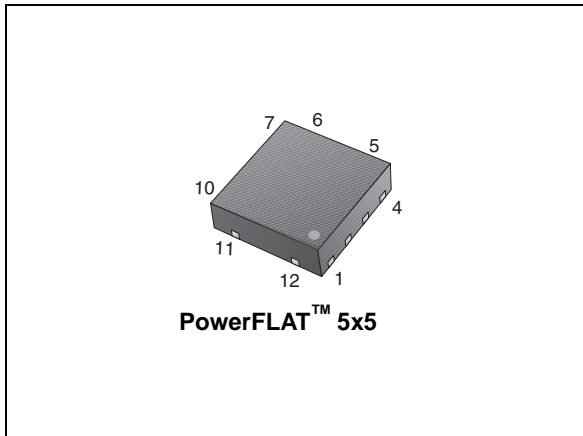## N-channel 650 V, 0.475 Ω typ., 8.5 A MDmesh™ M5 Power MOSFET in a PowerFLAT™ 5x5 package

Datasheet - production data

PowerFLAT™ 5x5

Features

Order code	V_{DS} @ $T_{j\ max.}$	$R_{DS(on)}$ max	I_D
STL11N65M5	710 V	0.530 Ω	8.5 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 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.

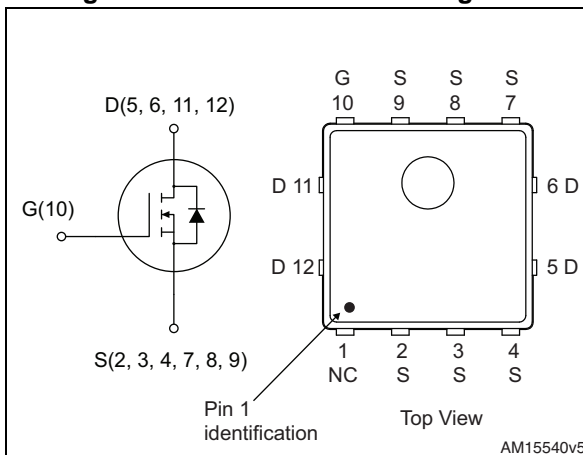**Figure 1. Internal schematic diagrams**

Table 1. Device summary

Order code	Marking	Package	Packaging
STL11N65M5	11N65M5	PowerFLAT™ 5x5	Tape and reel

Contents

1   Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	650	V
V_{GS}	Gate-source voltage	± 25	V
I_D [1]	Drain current (continuous) at T_C = 25 °C	8.5	A
I_D [1]	Drain current (continuous) at T_C = 100 °C	4.9	A
I_{DM} [1],[2]	Drain current (pulsed)	34	A
I_D [3]	Drain current (continuous) at T_{pcb}=25°C	1.35	A
$I_{D(3)}$	Drain current (continuous) at T_{pcb}=100°C	0.86	A
$I_{DM(2),(3)}$	Drain current (pulsed)	5.4	A
P_{TOT} [1]	Total dissipation at T_C = 25 °C	70	W
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	1.9	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	130	mJ
dv/dt [4]	Peak diode recovery voltage slope	15	V/ns
T_{stg}	Storage temperature	- 55 to 150	°C
T_j	Max. operating junction temperature		°C

1. Limited by maximum junction temperature
2. Pulse width limited by safe operating area.
3. When mounted on FR-4 Board of 1 inch², 2 oz Cu (t < 100 s)
4. $I_{SD} \leq$ 8.5 A, di/dt $\leq$ 400 A/µs, $V_{Peak} \leq V_{(BR)DSS}$, V_{DD} = 400 V.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1.78	°C/W
$R_{thj\text{-}pcb}$ [1]	Thermal resistance junction-pcb max	58.5	°C/W

1. When mounted on 1inch² FR-4 board, 2 oz Cu, t<100 sec

2   Electrical characteristics

(T_C = 25 °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)	I_D = 1 mA	650			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 650 V			1	µA
		V_{DS} = 650 V, T_C=125 °C			100	µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 25 V			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 4.25 A		0.475	0.530	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 100 V, f = 1 MHz, V_{GS} = 0	-	644	-	pF
C_{oss}	Output capacitance		-	18	-	pF
C_{rss}	Reverse transfer capacitance		-	2.5	-	pF
$C_{o(tr)}$[1]	Equivalent capacitance time related	V_{DS} = 0 to 520 V, V_{GS} = 0	-	55	-	pF
$C_{o(er)}$[2]	Equivalent capacitance energy related		-	17	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	5	-	Ω
Q_g	Total gate charge	V_{DD} = 520 V, I_D = 4.5 A, V_{GS} = 10 V (see *Figure 16*)	-	17	-	nC
Q_{gs}	Gate-source charge		-	4.6	-	nC
Q_{gd}	Gate-drain charge		-	8.5	-	nC

1. $C_{oss\ eq.}$ time related 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}

2. $C_{oss\ eq.}$ energy related is defined as a constant equivalent capacitance giving the same stored energy 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
$t_{d(v)}$	Voltage delay time	$V_{DD} = 400$ V, $I_D = 6$ A, $R_G = 4.7$ Ω, $V_{GS} = 10$ V (see *Figure 17*), (see *Figure 20*)	-	23	-	ns
$t_{r(v)}$	Voltage rise time		-	10	-	ns
$t_{f(i)}$	Current fall time		-	13.5	-	ns
$t_{c(off)}$	Crossing time		-	13	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} [1]	Source-drain current		-		8.5	A
I_{SDM} [1], [2]	Source-drain current (pulsed)		-		34	A
V_{SD} [3]	Forward on voltage	$I_{SD} = 8.5$ A, $V_{GS} = 0$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 8.5$ A, di/dt = 100 A/μs $V_{DD} = 60$ V (see *Figure 17*)	-	232		ns
Q_{rr}	Reverse recovery charge		-	2		μC
I_{RRM}	Reverse recovery current		-	17.5		A
t_{rr}	Reverse recovery time	$I_{SD} = 8.5$ A, di/dt = 100 A/μs $V_{DD} = 60$ V, $T_j = 150$ °C (see *Figure 17*)	-	328		ns
Q_{rr}	Reverse recovery charge		-	2.8		μC
I_{RRM}	Reverse recovery current		-	17		A

1. Limited by maximum junction temperature

2. Pulse width limited by safe operating area

3. Pulsed: pulse duration = 300 μs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area
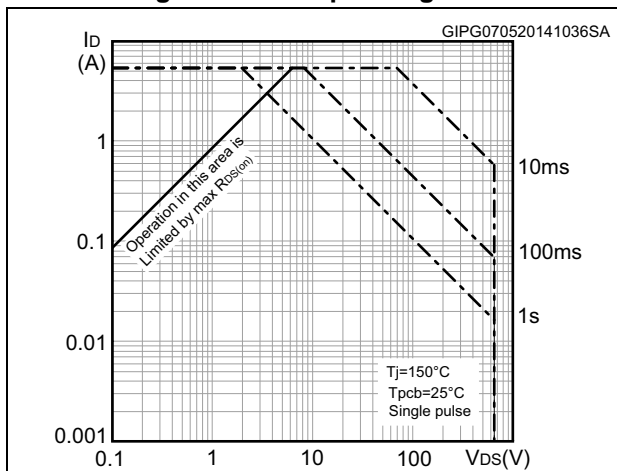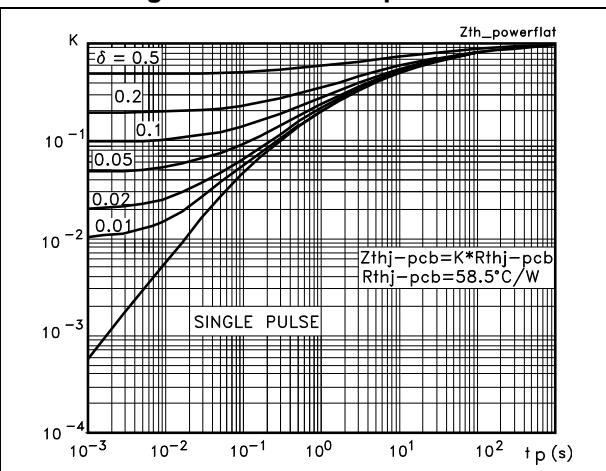

Figure 3. Thermal impedance

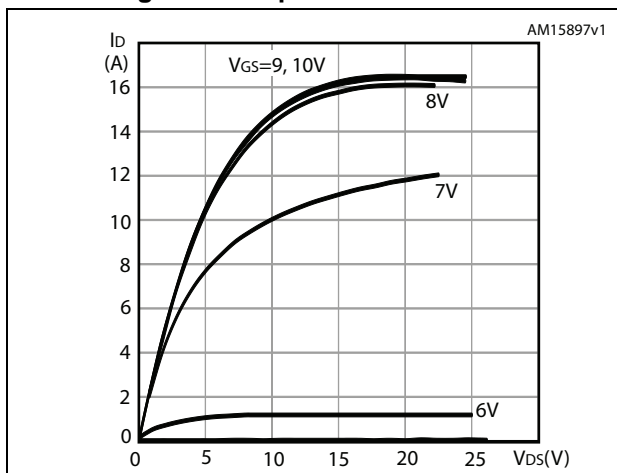**Figure 4. Output characteristics**
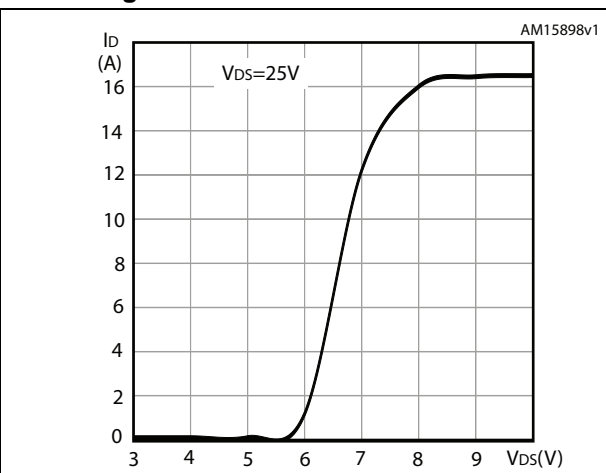

Figure 5. Transfer characteristics

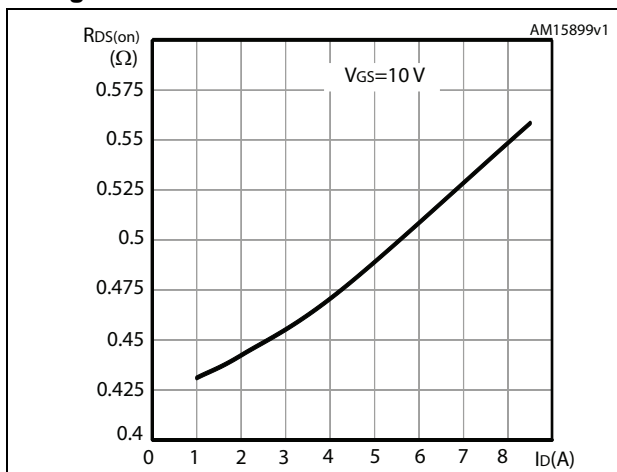**Figure 6. Static drain-source on-resistance**

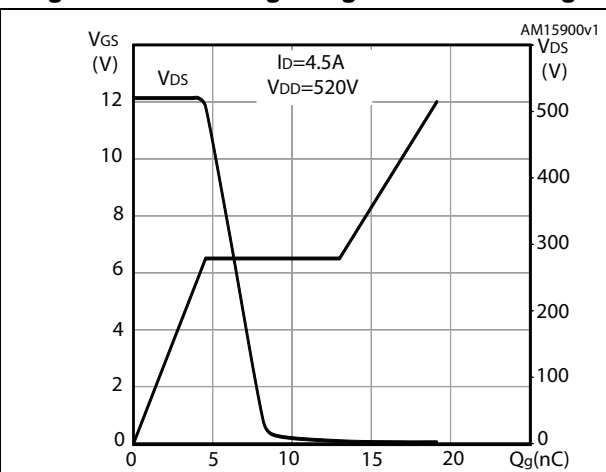
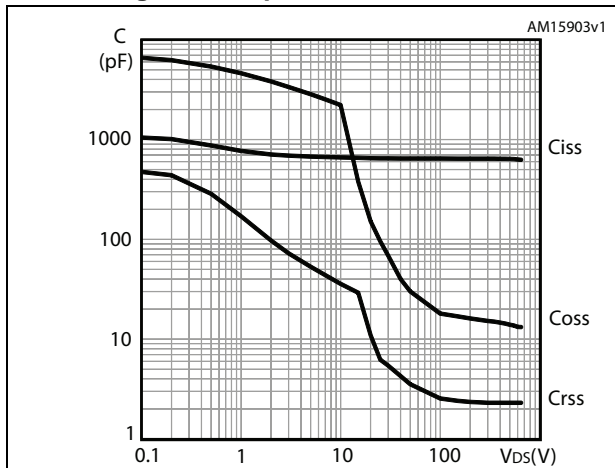**Figure 7. Gate charge vs gate-source voltage**

Figure 8. Capacitance variations

Figure 9. Output capacitance stored energy

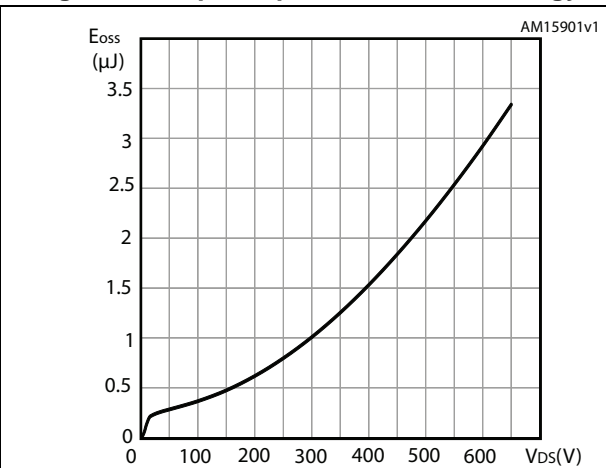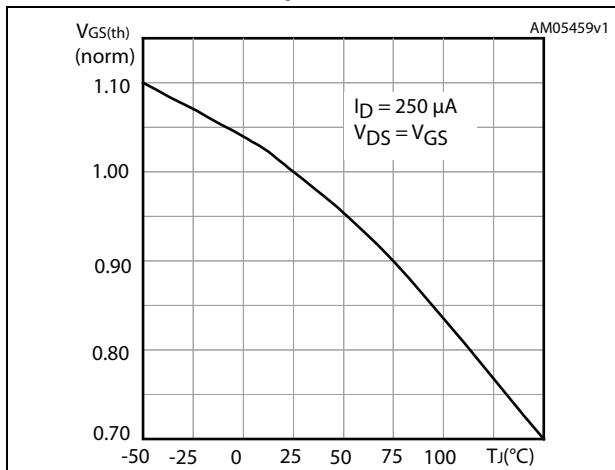**Figure 10. Normalized gate threshold voltage vs temperature**
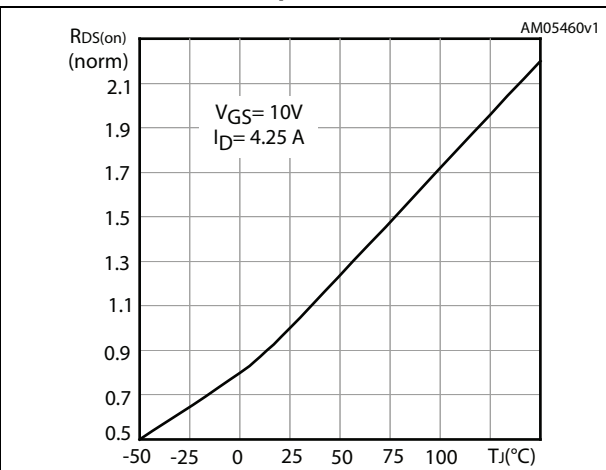

Figure 11. Normalized on-resistance vs temperature

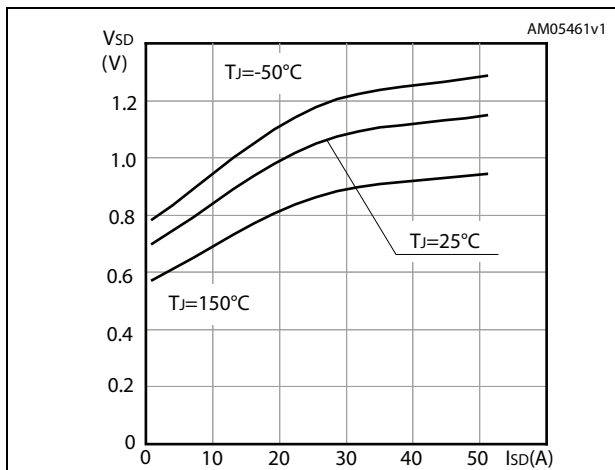**Figure 12. Source-drain diode forward characteristics**
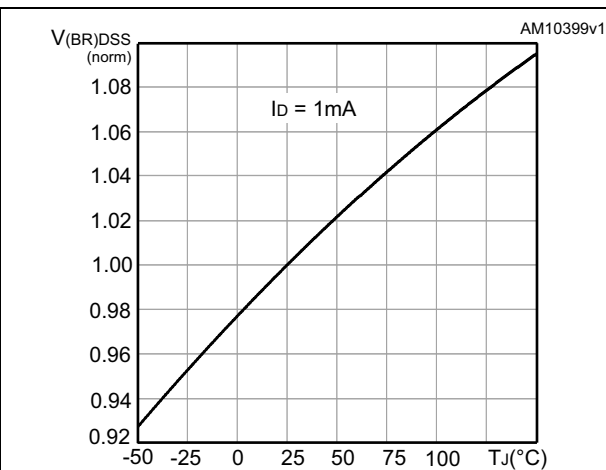

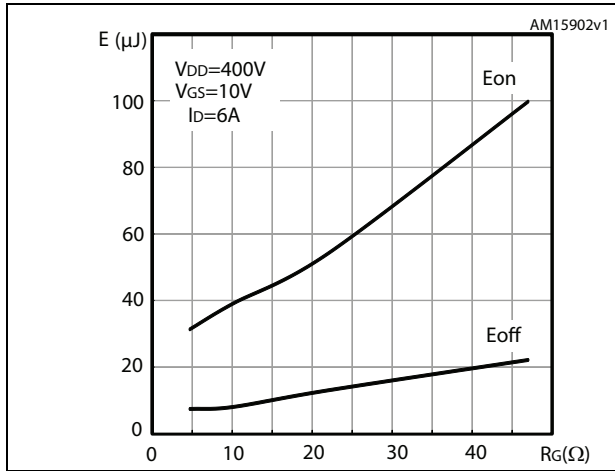**Figure 13. Normalized $V_{(BR)DSS}$ vs temperature**

Figure 14. Switching losses vs gate resistance [1]

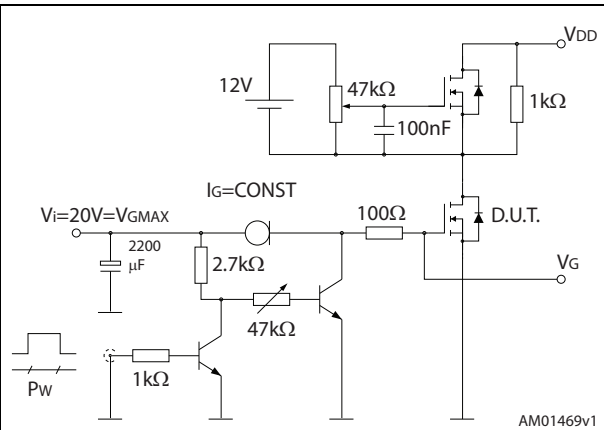1. Eon including reverse recovery of a SiC diode

3 Test circuits

Figure 15. Switching times test circuit for resistive load
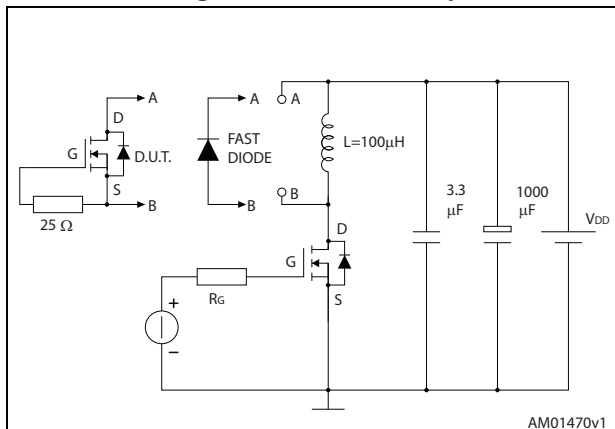

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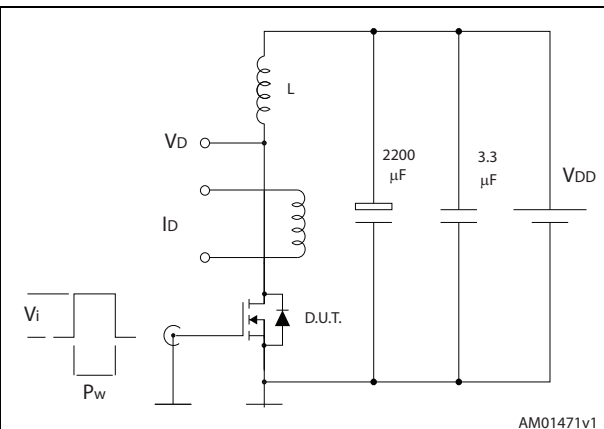**Figure 16. Gate charge test circuit**

AM01469v1

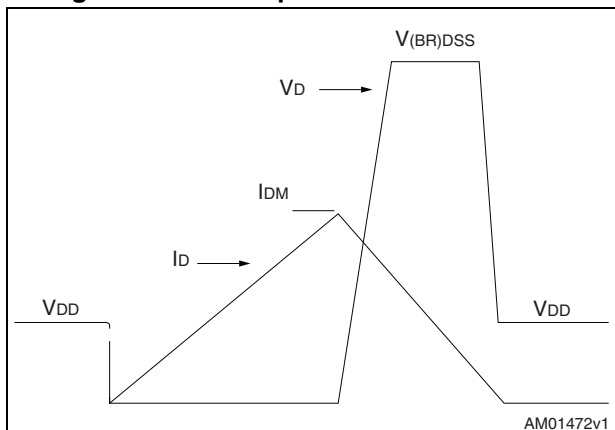**Figure 17. Test circuit for inductive load switching and diode recovery times**

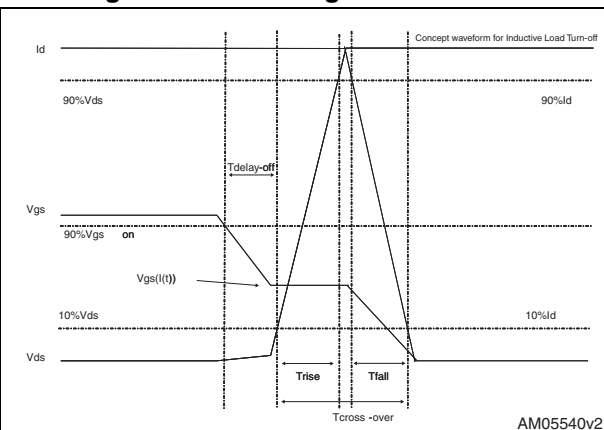AM01470v1

Figure 18. Unclamped inductive load test circuit

AM01471v1

Figure 19. Unclamped inductive waveform

AM01472v1

Figure 20. Switching time waveform

AM05540v2

4 Package mechanical data

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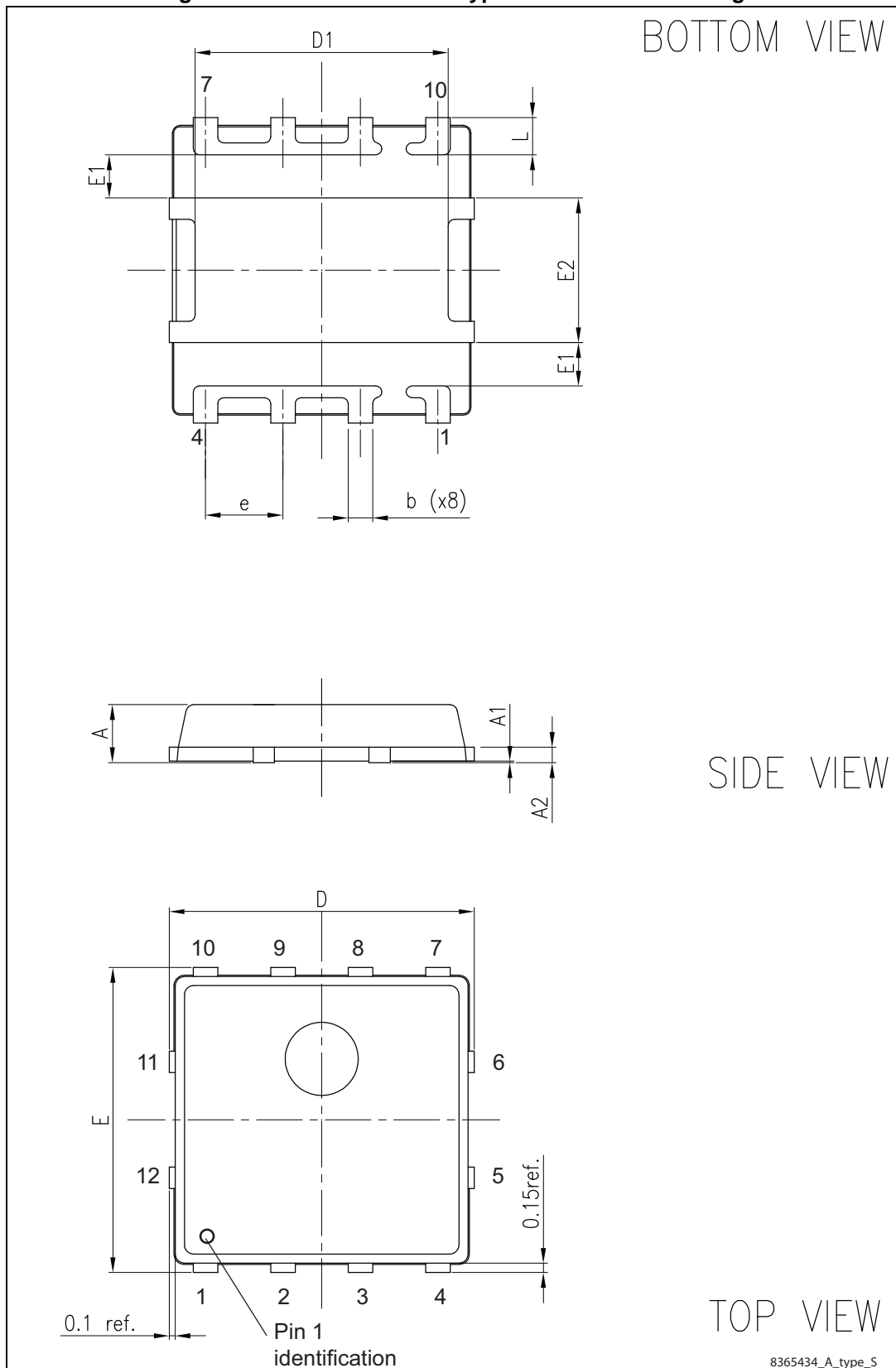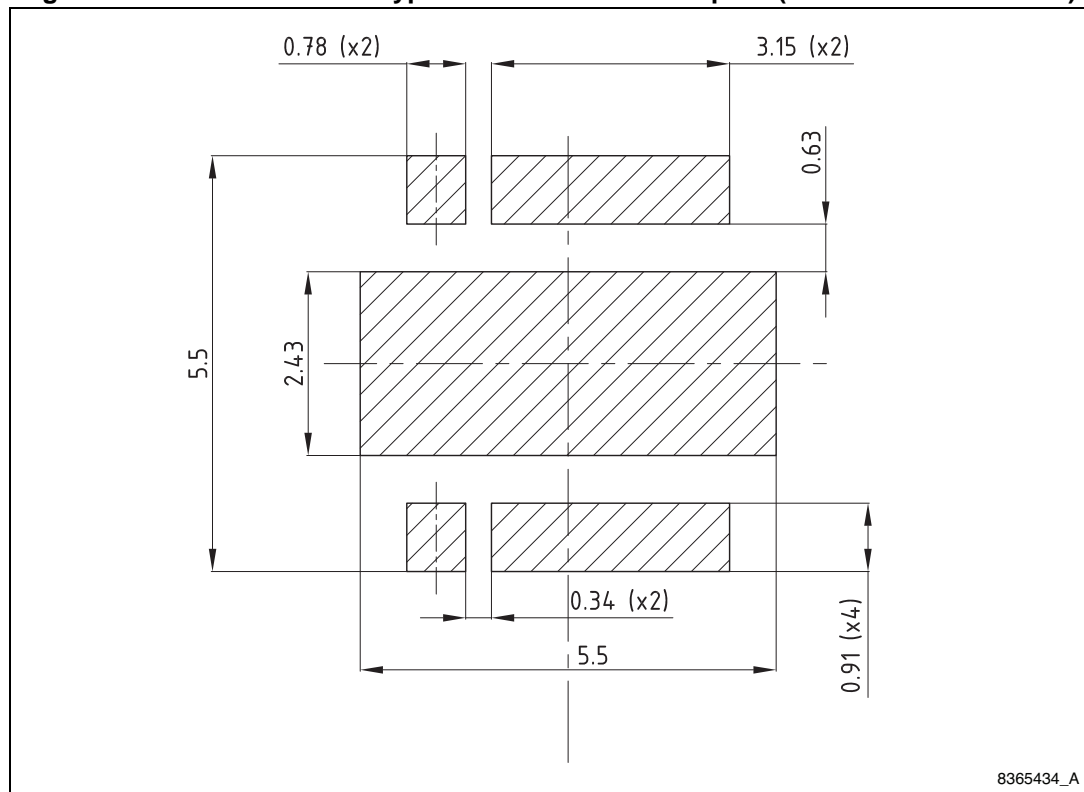**Figure 21. PowerFLAT™ 5x5 type S mechanical drawing**

Table 8. PowerFLAT™ 5x5 type S mechanical dimensions

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 22. PowerFLAT™ 5x5 type S recommended footprint (dimensions are in mm)

8365434_A

5 Revision history

Table 9. Document revision history

Date	Revision	Changes
09-May-2014	1	First release
29-Sep-2014	2	Updated title, features and description in cover page. Document status promoted from preliminary to production data.

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