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STY112N65M5

N-channel 650 V, 0.019 Ω , 96 A, MDmesh™ V Power MOSFET in Max247 package

Datasheet — production data

Features

Order code	V_{DSS} @ T_{jMAX}	$R_{DS(on)}$ max	I_D
STY112N65M5	710 V	< 0.022 Ω	96 A

- Higher V_{DSS} rating
- Higher dv/dt capability
- Excellent switching performance
- Easy to drive
- 100% avalanche tested

Applications

- Switching applications

Description

This device is an N-channel MDmesh™ V Power MOSFET based on an innovative proprietary vertical process technology, which is combined with STMicroelectronics' well-known PowerMESH™ horizontal layout structure. The resulting product has extremely low on-resistance, which is unmatched among silicon-based Power MOSFETs, making it especially suitable for applications which require superior power density and outstanding efficiency.

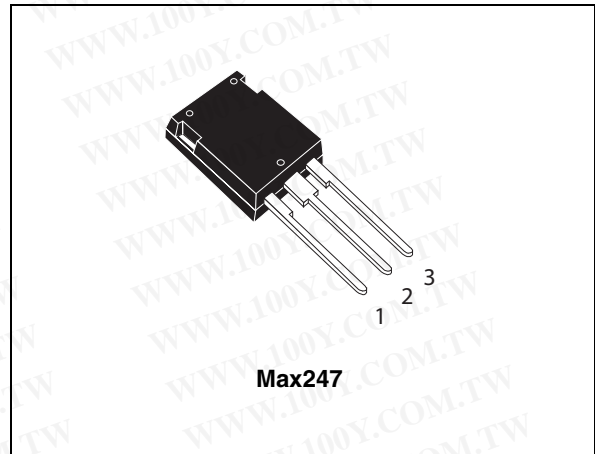


Figure 1. Internal schematic diagram

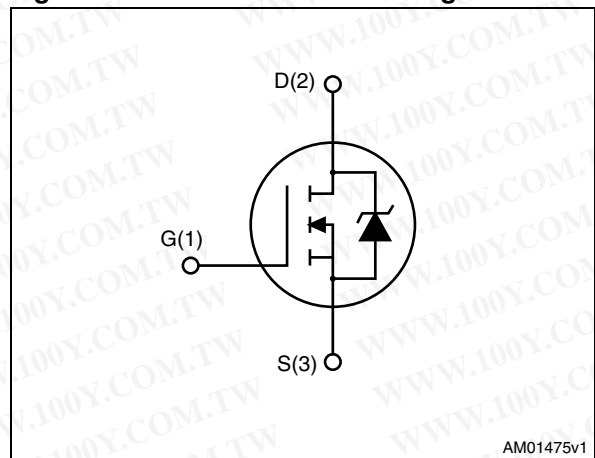


Table 1. Device summary

Order code	Marking	Package	Packaging
STY112N65M5	112N65M5	Max247	Tube

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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 $T_C = 25\text{ }^\circ\text{C}$	96	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	61	A
$I_{DM}^{(1)}$	Drain current (pulsed)	384	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	625	W
I_{AR}	Max current during repetitive or single pulse avalanche (pulse width limited by T_{JMAX})	17	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{V}$)	2400	mJ
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
T_{stg}	Storage temperature	- 55 to 150	$^\circ\text{C}$
T_j	Max. operating junction temperature	150	$^\circ\text{C}$

1. Pulse width limited by safe operating area.
2. $I_{SD} \leq 96\text{ A}$, $di/dt = 400\text{ A}/\mu\text{s}$, $V_{DD} = 400\text{ V}$, peak $V_{DS} < V_{(BR)DSS}$.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.2	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	30	$^\circ\text{C}/\text{W}$
T_l	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

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	$I_D = 1\text{ mA}$, $V_{GS} = 0$	650			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 650\text{ V}$ $V_{DS} = 650\text{ V}$, $T_C = 125\text{ °C}$			10 100	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 25\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 48\text{ A}$		0.019	0.022	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	16870	-	pF
C_{oss}	Output capacitance			365		
C_{rss}	Reverse transfer capacitance			7		
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{GS} = 0$, $V_{DS} = 0\text{ to }520\text{ V}$	-	1333	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related	$V_{GS} = 0$, $V_{DS} = 0\text{ to }520\text{ V}$	-	350	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	1.26	-	Ω
Q_g	Total gate charge	$V_{DD} = 520\text{ V}$, $I_D = 48\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 15)	-	350	-	nC
Q_{gs}	Gate-source charge			97		
Q_{gd}	Gate-drain charge			118		

1. $C_{o(tr)}$ 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} .

2. $C_{o(er)}$ 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} .

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(v)}$	Voltage delay time	$V_{DD} = 400\text{ V}$, $I_D = 64\text{ A}$,		267		ns
$t_{r(v)}$	Voltage rise time	$R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$	-	79	-	ns
$t_{f(i)}$	Current fall time	(see Figure 16)		53		ns
$t_{c(off)}$	Crossing time	(see Figure 19)		140		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		96	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		384	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 96\text{ A}$, $V_{GS} = 0$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 96\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$	-	570		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 100\text{ V}$ (see Figure 16)	-	17		μC
I_{RRM}	Reverse recovery current			60		A
t_{rr}	Reverse recovery time	$I_{SD} = 96\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$	-	695		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 100\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$	-	26		μC
I_{RRM}	Reverse recovery current	(see Figure 16)		73		A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

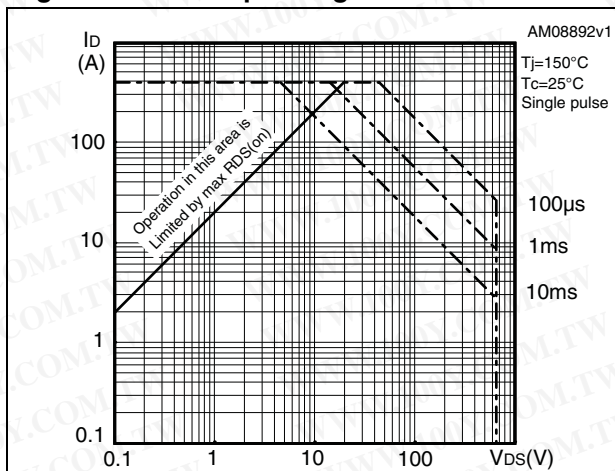


Figure 3. Thermal impedance

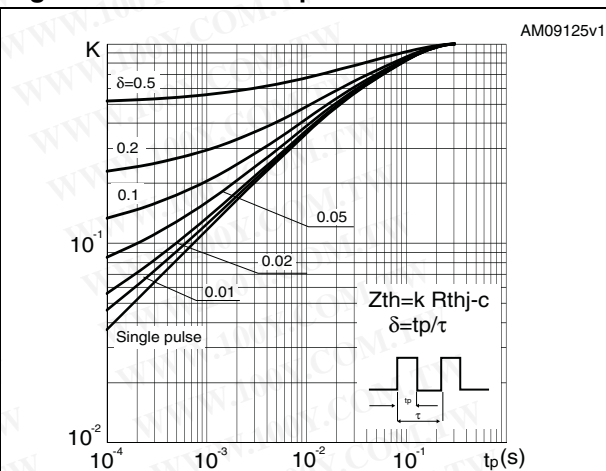


Figure 4. Output characteristics

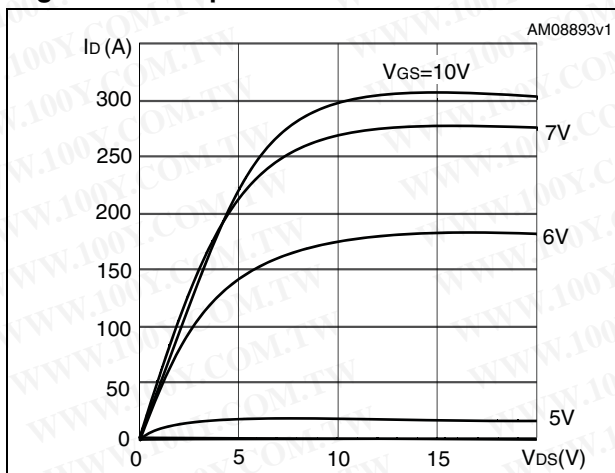


Figure 5. Transfer characteristics

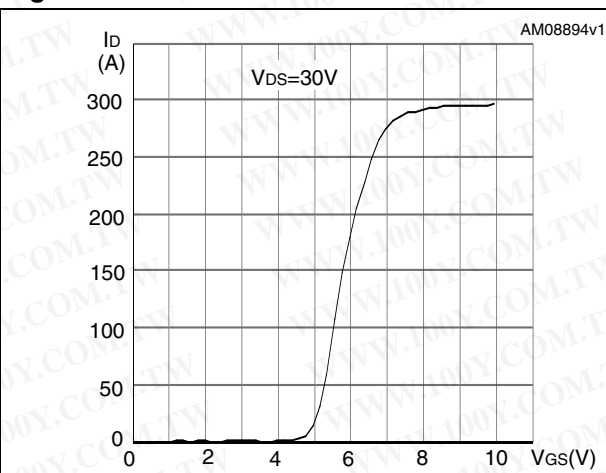


Figure 6. Normalized V_{DS} vs temperature

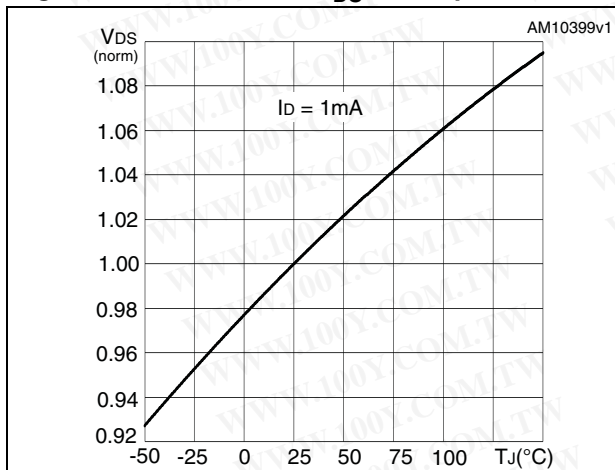


Figure 7. Static drain-source on resistance

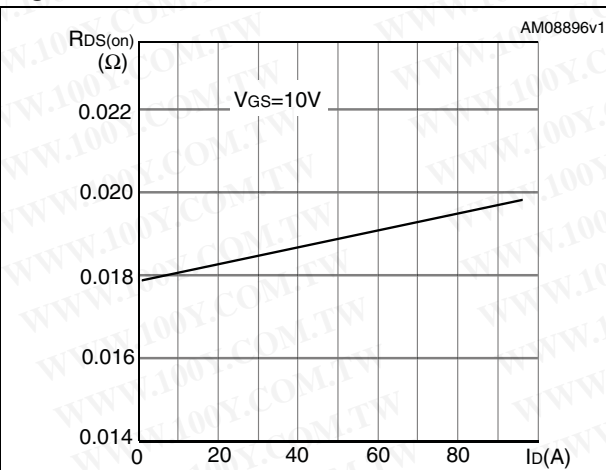


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

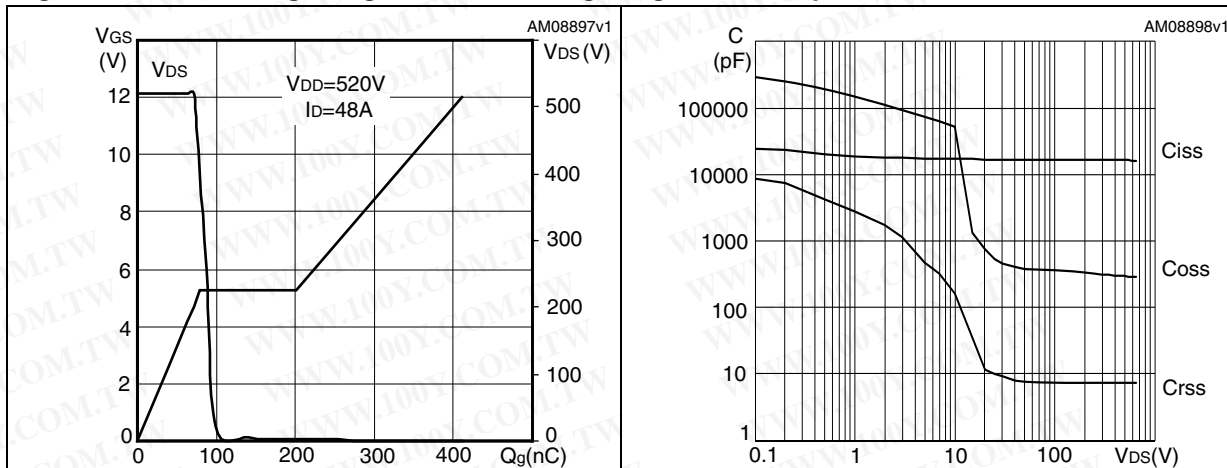


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

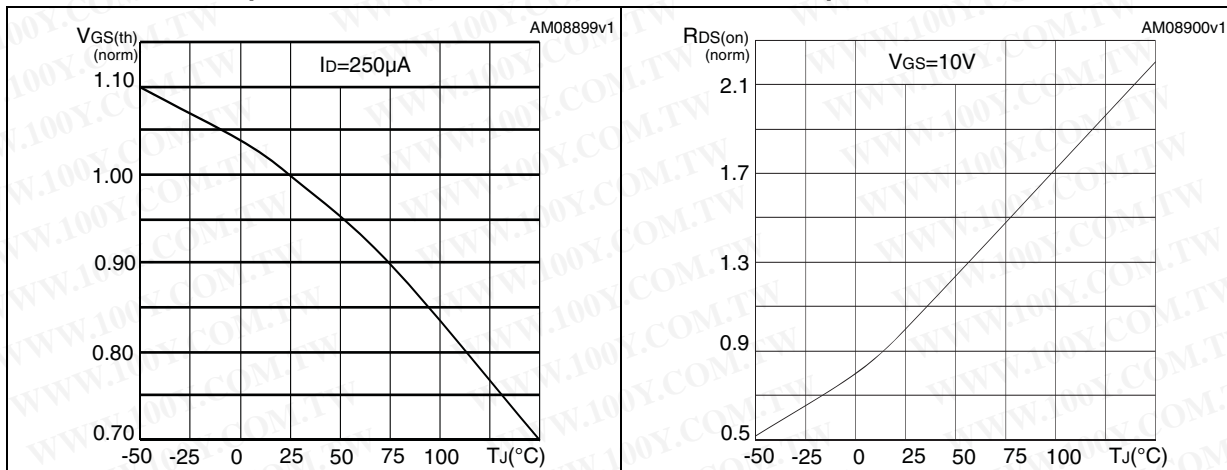
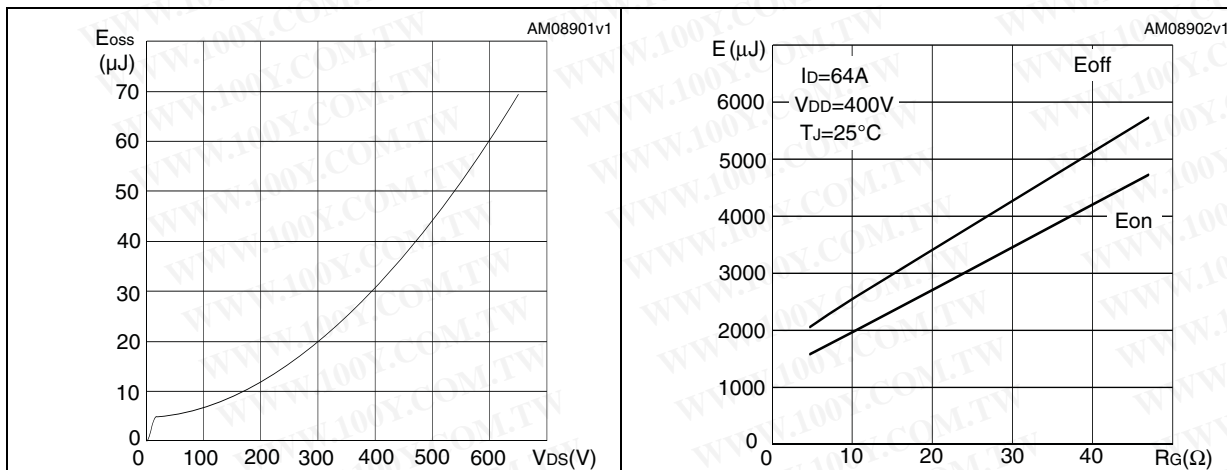


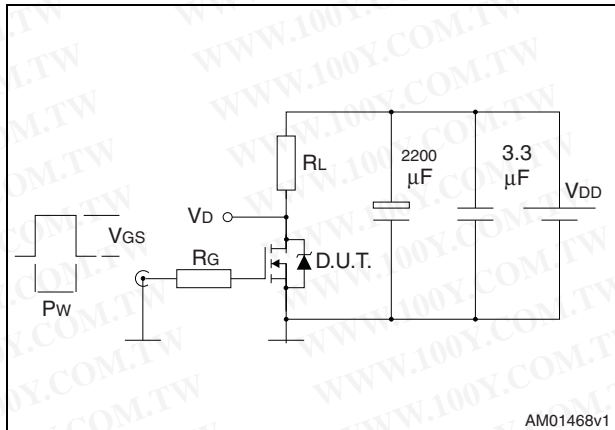
Figure 12. Output capacitance stored energy Figure 13. Switching losses vs gate resistance (1)



1. E_{on} including reverse recovery of a SiC diode

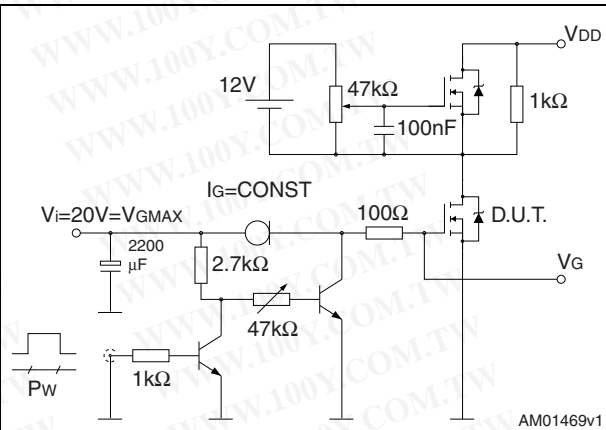
3 Test circuits

Figure 14. Switching times test circuit for resistive load



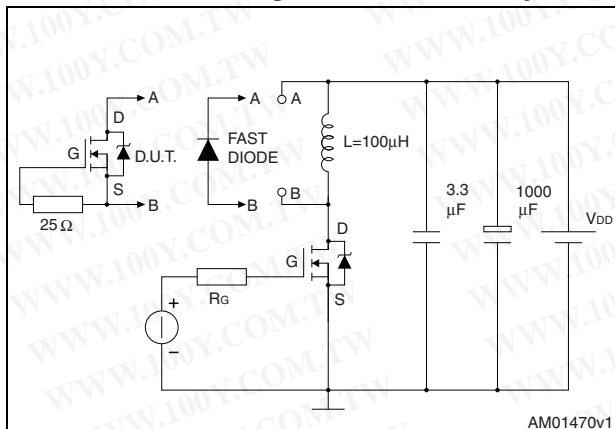
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Figure 15. Gate charge test circuit



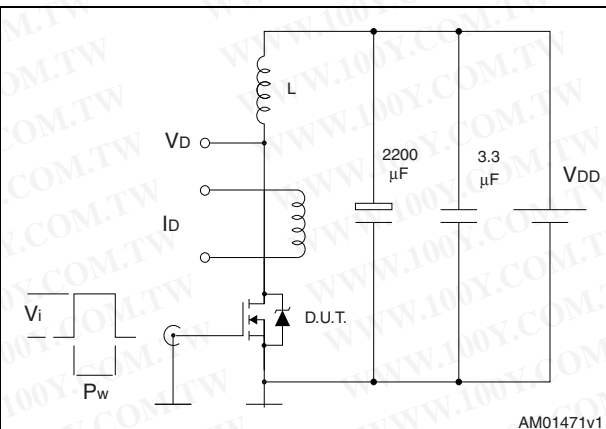
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Figure 16. Test circuit for inductive load switching and diode recovery times



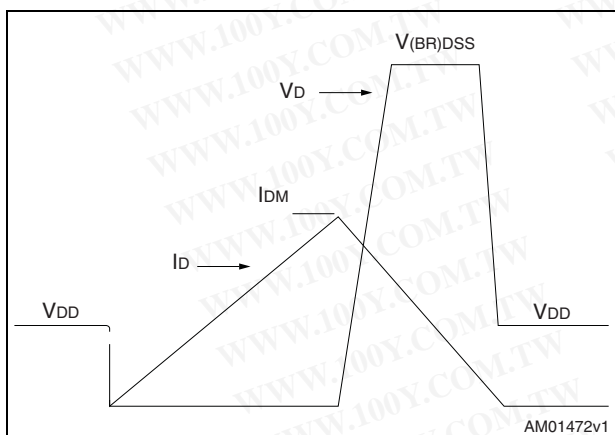
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Figure 17. Unclamped inductive load test circuit



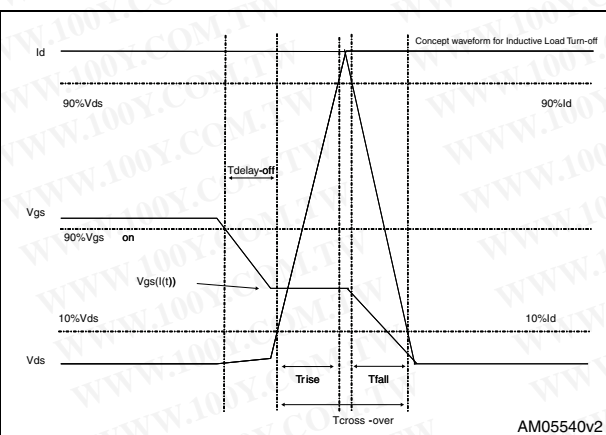
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Figure 18. Unclamped inductive waveform



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Figure 19. Switching time waveform



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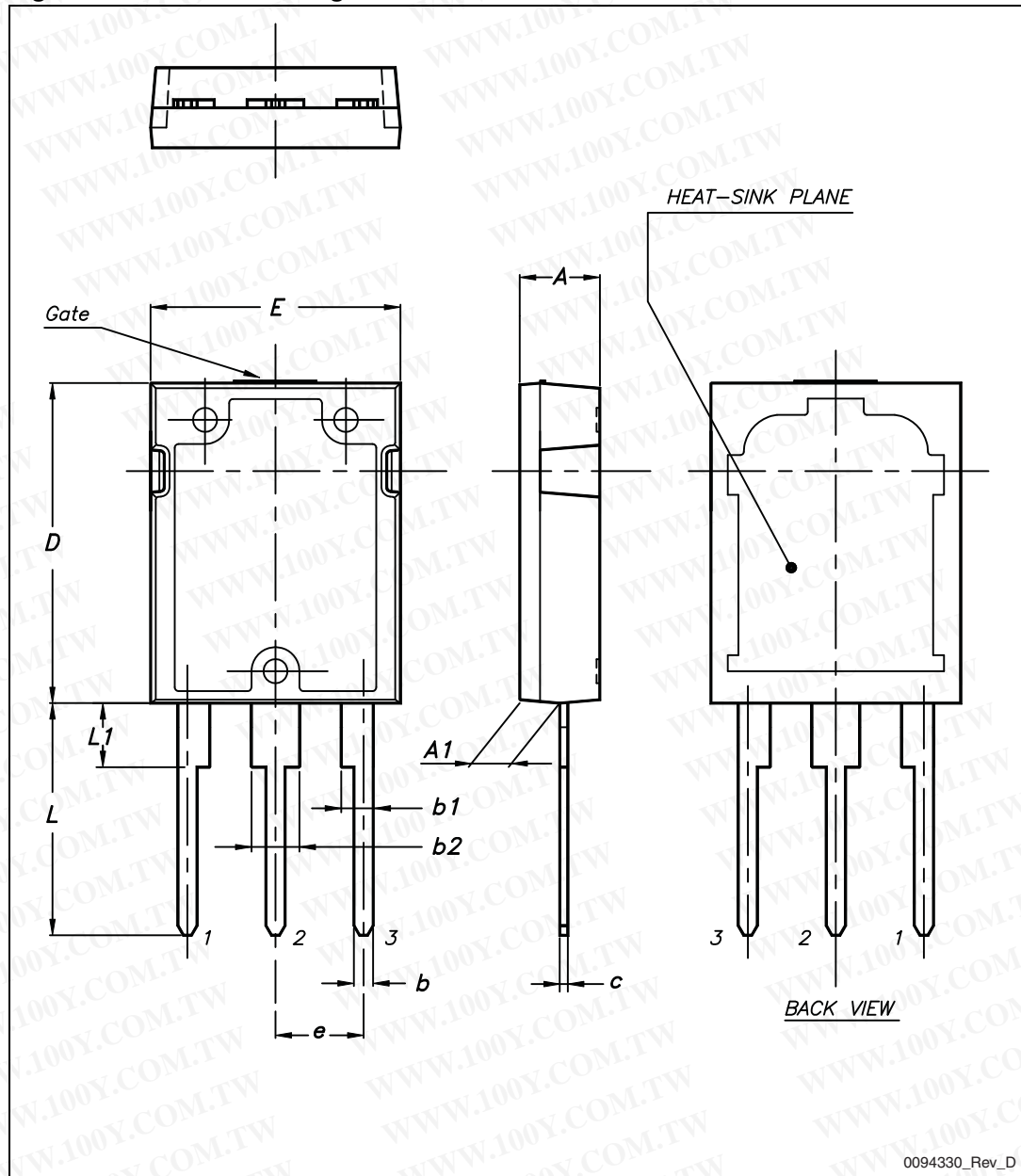
4 Package mechanical data

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.

Table 8. Max247 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.70		5.30
A1	2.20		2.60
b	1.00		1.40
b1	2.00		2.40
b2	3.00		3.40
c	0.40		0.80
D	19.70		20.30
e	5.35		5.55
E	15.30		15.90
L	14.20		15.20
L1	3.70		4.30

Figure 20. Max247 drawing



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
20-Jan-2009	1	First release.
20-May-2011	2	Document status promoted from preliminary data to datasheet.
03-May-2012	3	<i>Section 4: Package mechanical data</i> has been updated.

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