



# STY100NM60N

N-channel 600 V, 0.028  $\Omega$  typ., 98 A MDmesh™ II  
Power MOSFET in a Max247 package

Datasheet — production data

## Features

Type	V <sub>DSS</sub> @ T <sub>Jmax</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STY100NM60N	650 V	< 0.029 $\Omega$	98 A

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

## Applications

- Switching applications

## Description

This device is an N-channel Power MOSFET developed using the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

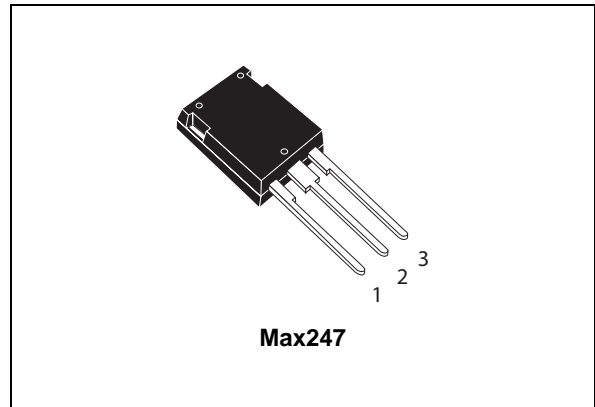


Figure 1. Internal schematic diagram

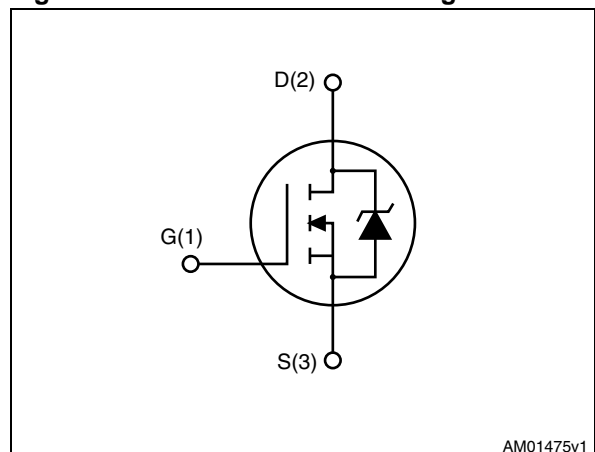


Table 1. Device summary

Order code	Marking	Package	Packaging
STY100NM60N	100NM60N	Max247	Tube

# Contents

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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 $T_C = 25\text{ °C}$	98	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ °C}$	62	A
$I_{DM}^{(1)}$	Drain current (pulsed)	392	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ °C}$	625	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
$T_{stg}$	Storage temperature	- 55 to 150	°C
$T_j$	Max. operating junction temperature		°C

1. Pulse width limited by safe operating area.
2.  $I_{SD} \leq 98\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DS\text{ peak}} \leq V_{(BR)DSS}$ ,  $V_{DD} = 80\% V_{(BR)DSS}$ .

**Table 3. Thermal data**

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

**Table 4. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not repetitive (pulse width limited by $T_{jmax}$ )	15	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j=25\text{ °C}$ , $I_D=I_{ar}$ , $V_{DD}=50$ )	757	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 ( $V_{GS} = 0$ )	$I_D = 1\text{ mA}$	600			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 600\text{ V}$ $V_{DS} = 600\text{ V}, T_C = 125\text{ °C}$			10 150	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 25\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	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	$V_{GS} = 10\text{ V}, I_D = 49\text{ A}$		0.028	0.029	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 50\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$	-	9600	-	pF
$C_{oss}$	Output capacitance			850		pF
$C_{rss}$	Reverse transfer capacitance			50		pF
$C_{oss(eq)}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }480\text{ V}, V_{GS} = 0$	-	1602	-	pF
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	1.3	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 480\text{ V}, I_D = 98\text{ A},$ $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15</a> )	-	330	-	nC
$Q_{gs}$	Gate-source charge			40		nC
$Q_{gd}$	Gate-drain charge			174		nC

1.  $C_{oss(eq)}$  is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DS}$

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}, I_D = 49\text{ A},$ $R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ (see <a href="#">Figure 16</a> ) and (see <a href="#">Figure 19</a> )	-	45	-	ns
$t_r$	Rise time			52		ns
$t_{d(off)}$	Turn-off delay time			372		ns
$t_f$	Fall time			81		ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		98	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		392	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 98 \text{ A}, V_{GS} = 0$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 98 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$	-	622		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 60 \text{ V}$	-	16.5		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	(see <a href="#">Figure 16</a> )	-	52.5		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 98 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$	-	820		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 60 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$	-	27		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	(see <a href="#">Figure 16</a> )	-	66		A

1. Pulse width limited by safe operating area.
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

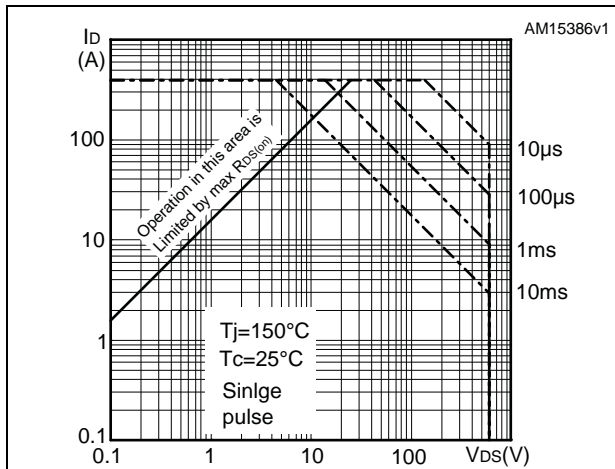


Figure 3. Thermal impedance

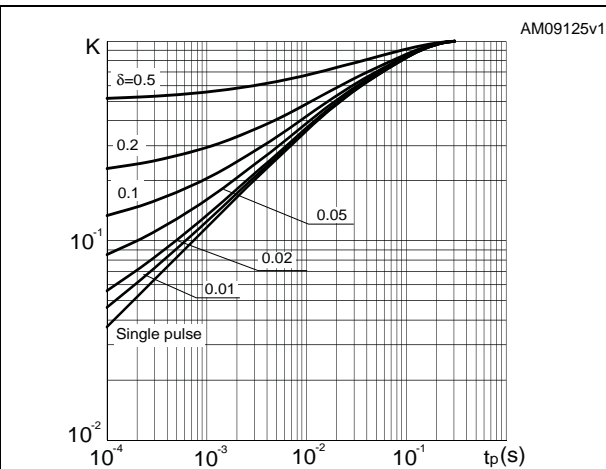


Figure 4. Output characteristics

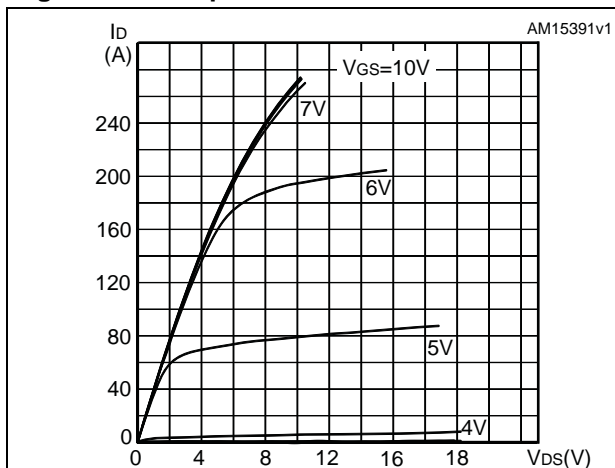


Figure 5. Transfer characteristics

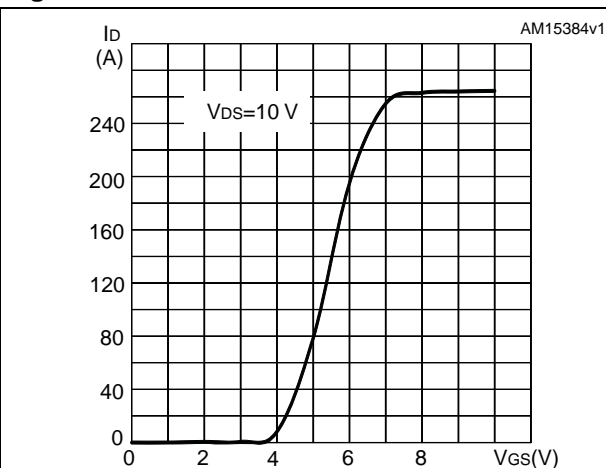


Figure 6. Gate charge vs gate-source voltage

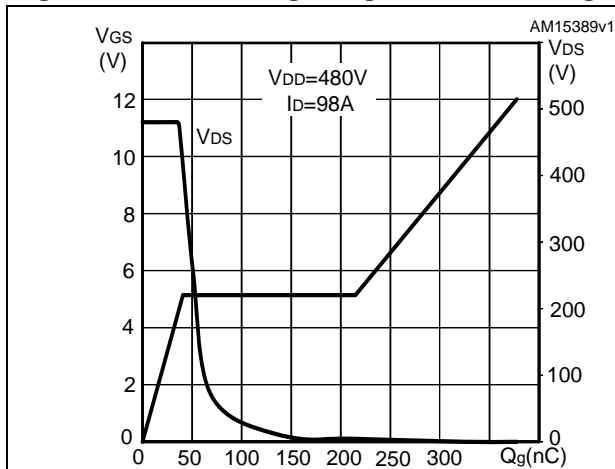


Figure 7. Static drain-source on-resistance

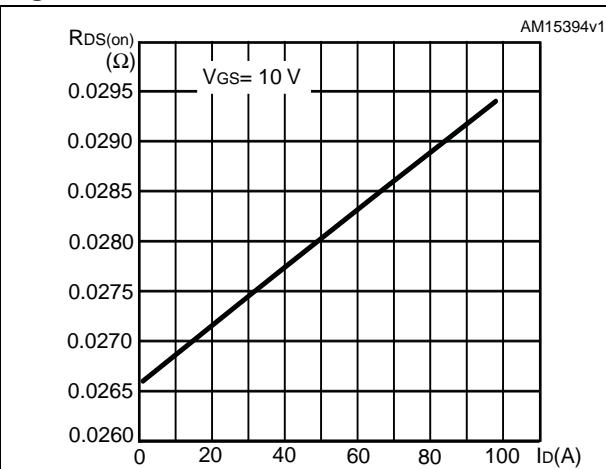


Figure 8. Capacitance variations

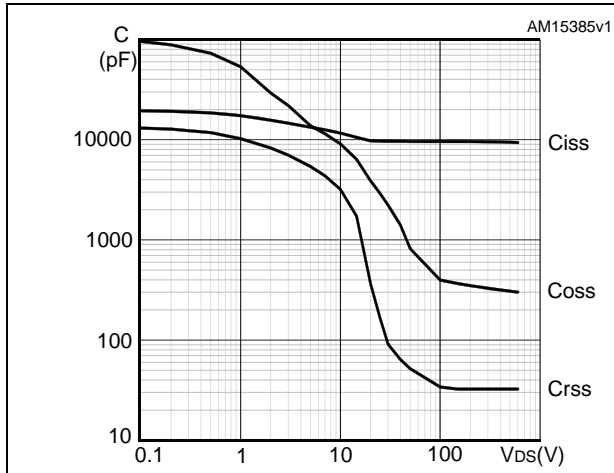


Figure 9. Normalized on-resistance vs temperature

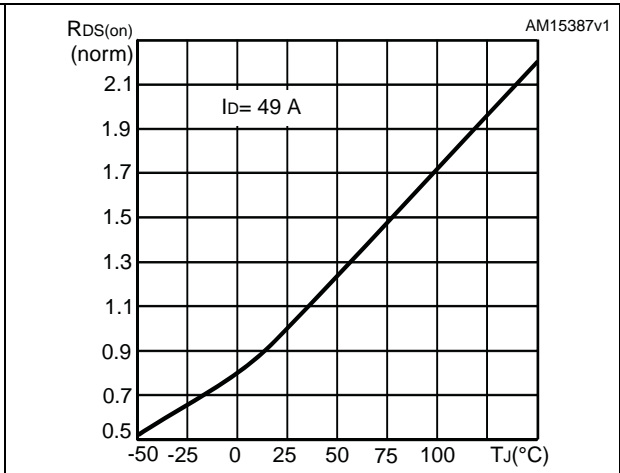


Figure 10. Normalized gate threshold voltage vs temperature

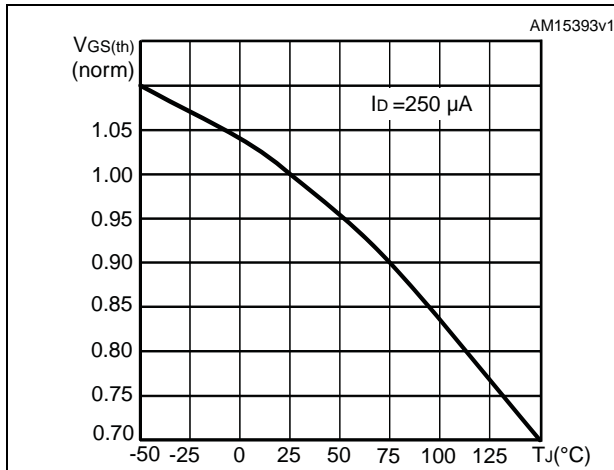


Figure 11. Normalized BV<sub>DSS</sub> vs temperature

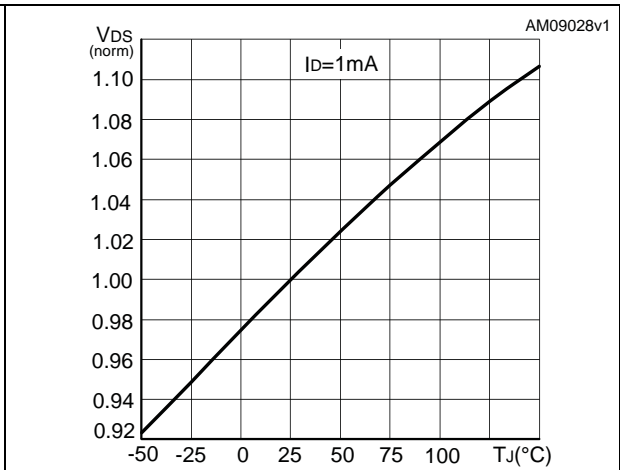


Figure 12. Source-drain diode forward characteristics

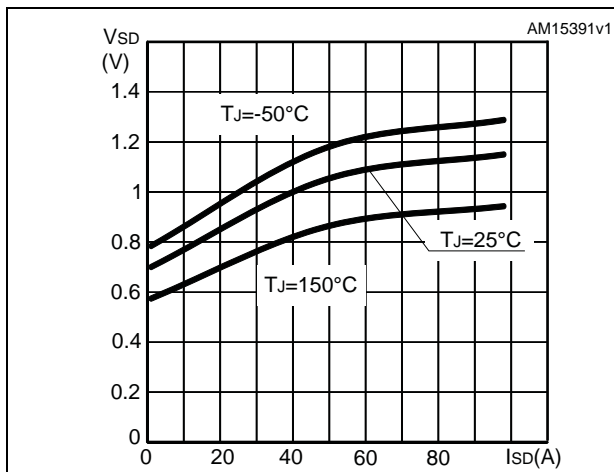
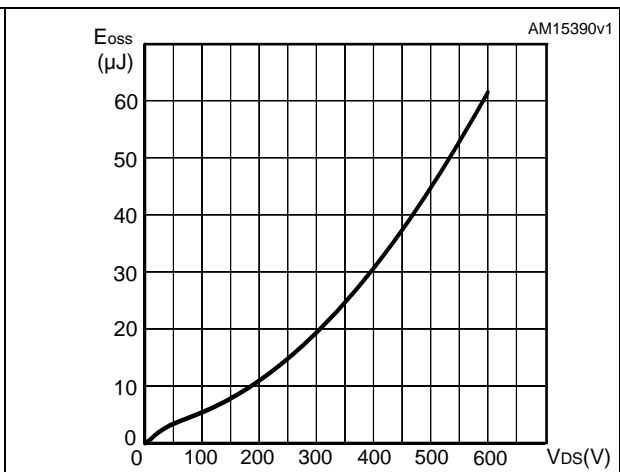


Figure 13. Output capacitance stored energy



### 3 Test circuits

Figure 14. Switching times test circuit for resistive load

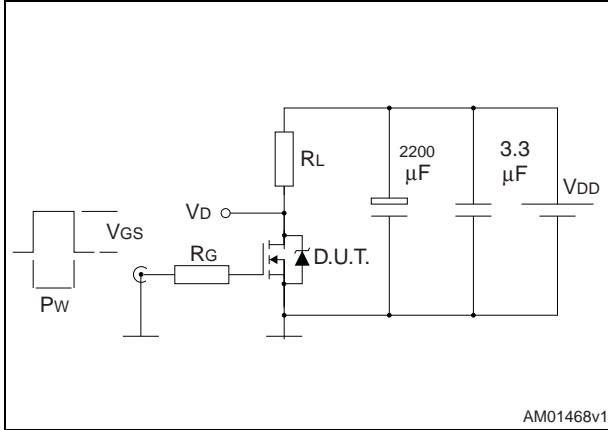


Figure 15. Gate charge test circuit

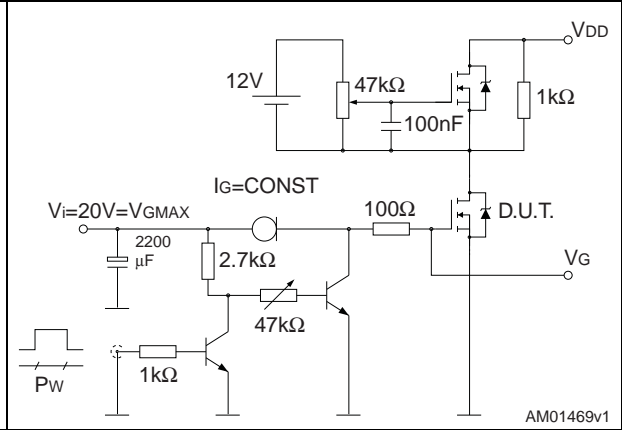


Figure 16. Test circuit for inductive load switching and diode recovery times

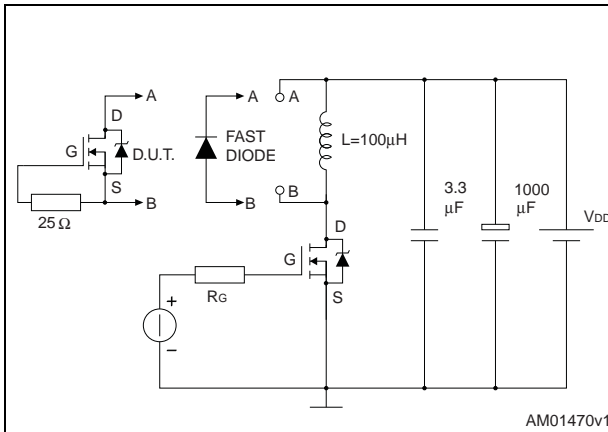


Figure 17. Unclamped inductive load test circuit

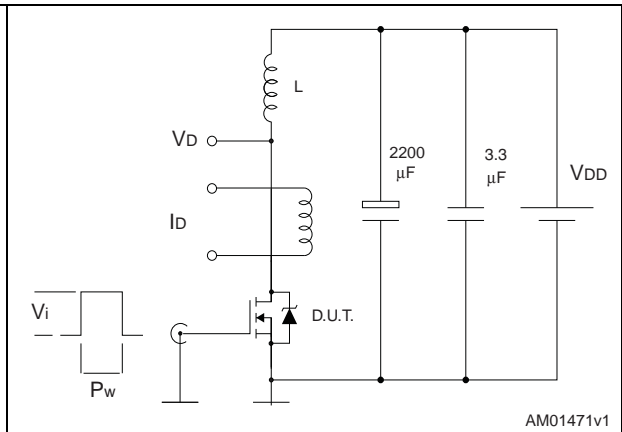


Figure 18. Unclamped inductive waveform

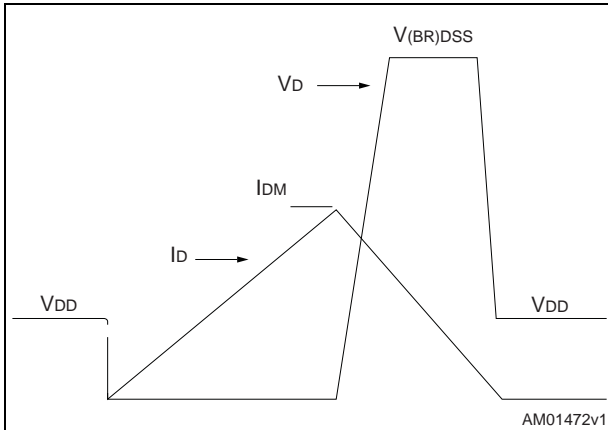
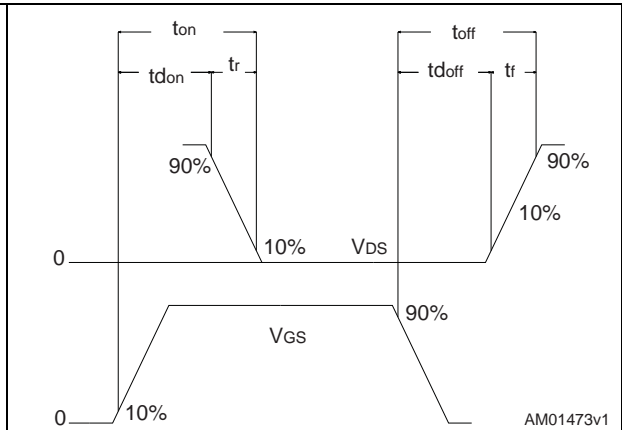


Figure 19. Switching time waveform





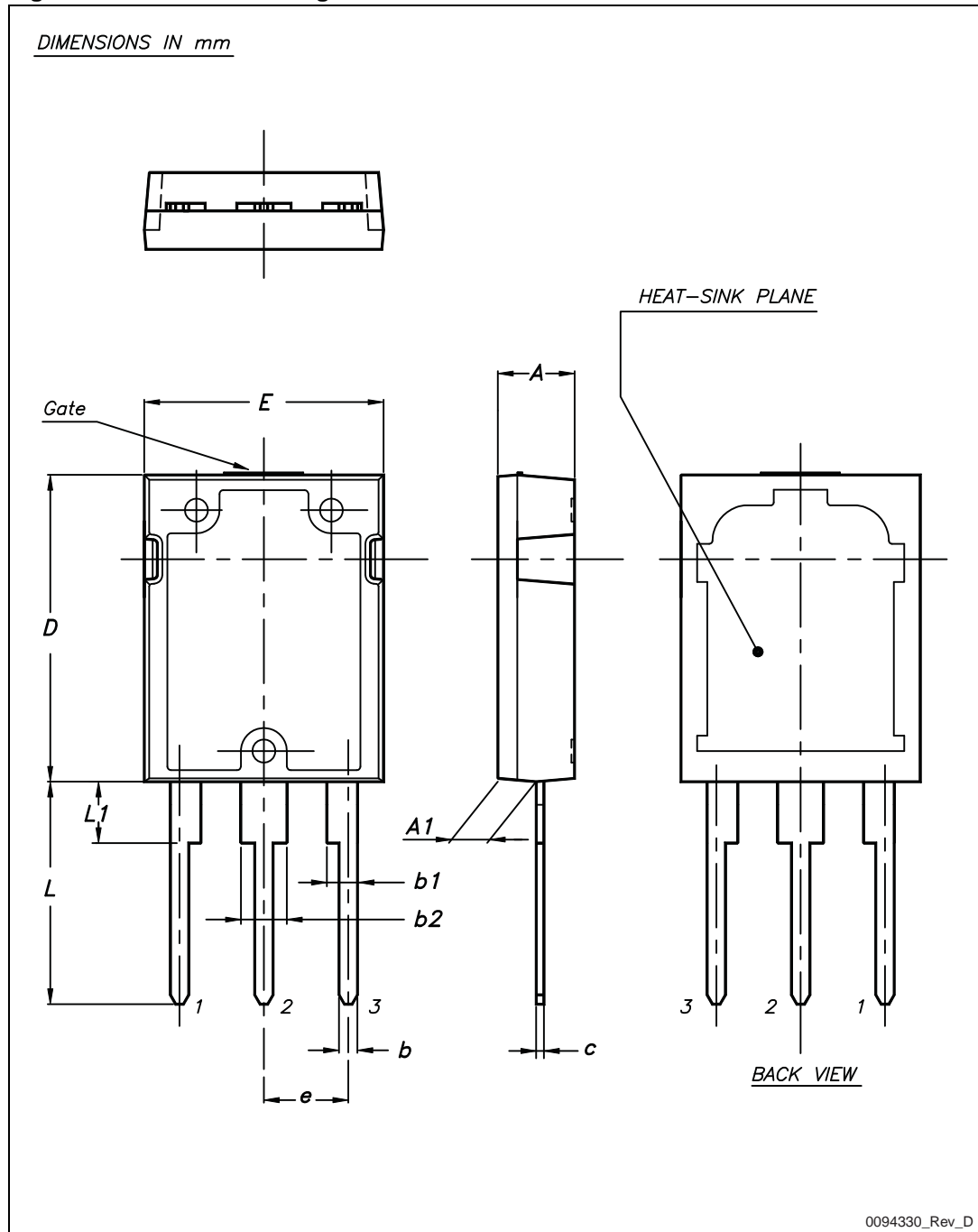
## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

Table 9. 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 10. Document revision history**

Date	Revision	Changes
14-Sep-2011	1	First release.
05-Nov-2012	2	Document status promoted from preliminary to production data. Added <a href="#">Section 2.1: Electrical characteristics (curves)</a> . Minor text changes.

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