

## N-channel 500 V, 0.40 $\Omega$ typ., 8.5 A MDmesh™ II Power MOSFET in a TO-220 package

Datasheet - obsolete product

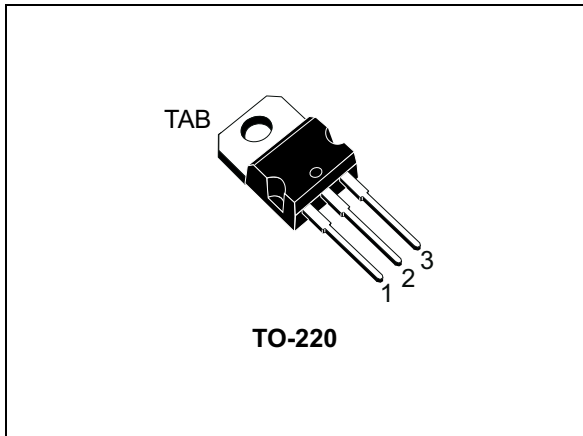
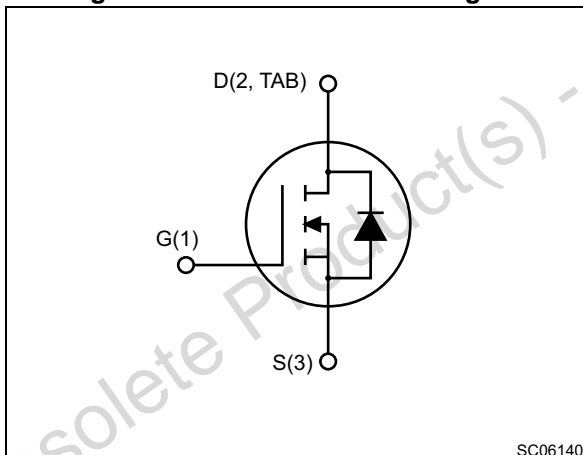


Figure 1. Internal schematic diagram



### Features

Order code	$V_{DS} @ T_J \text{ max}$	$R_{DS(on)} \text{ max}$	$I_D$
STP11NM50N	550 V	0.47 $\Omega$	8.5 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.

Table 1. Device summary

Order code	Marking	Package	Packaging
STP11NM50N	11NM50N	TO-220	Tube

# Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>4</b>
	2.1 Electrical characteristics (curves) .....	6
<b>3</b>	<b>Test circuits</b> .....	<b>8</b>
<b>4</b>	<b>Package information</b> .....	<b>9</b>
<b>5</b>	<b>Revision history</b> .....	<b>12</b>

Obsolete Product(s) - Obsolete Product(s)



# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	500	V
$V_{GS}$	Gate-source voltage	$\pm 25$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	8.5	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	6	A
$I_{DM}^{(1)}$	Drain current (pulsed)	34	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	70	W
$dv/dt^{(2)}$	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.  $I_{SD} \leq 8.5\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DSpeak} \leq V_{(BR)DSS}$ ,  $V_{DD} = 80\% V_{(BR)DSS}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.79	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$

**Table 4. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_{jmax}$ )	3	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J=25\text{ }^\circ\text{C}$ , $I_D=I_{AR}$ , $V_{DD}=50\text{ V}$ )	150	mJ

## 2 Electrical characteristics

( $T_{CASE} = 25\text{ °C}$  unless otherwise specified)

**Table 5. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$ , $V_{GS} = 0$	500			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 500\text{ V}$ $V_{DS} = 500\text{ V}$ , $T_C = 125\text{ °C}$			1 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 25\text{ V}$			$\pm 100$	$\mu\text{A}$
$V_{GS(th)}$	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	$V_{GS} = 10\text{ V}$ , $I_D = 4.5\text{ A}$		0.40	0.47	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 50\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	547	-	pF
$C_{oss}$	Output capacitance		-	42	-	pF
$C_{rss}$	Reverse transfer capacitance		-	2	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{GS} = 0$ , $V_{DS} = 0\text{ to }400\text{ V}$	-	210	-	pF
$Q_g$	Total gate charge	$V_{DD} = 400\text{ V}$ , $I_D = 8.5\text{ A}$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 14</a> )	-	19	-	nC
$Q_{gs}$	Gate-source charge		-	3.7	-	nC
$Q_{gd}$	Gate-drain charge		-	10	-	nC
$R_G$	Gate input resistance	$f = 1\text{ MHz}$ , $I_D = 0$	-	5.8	-	$\Omega$

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%  $V_{DS}$

Table 7. Switching times

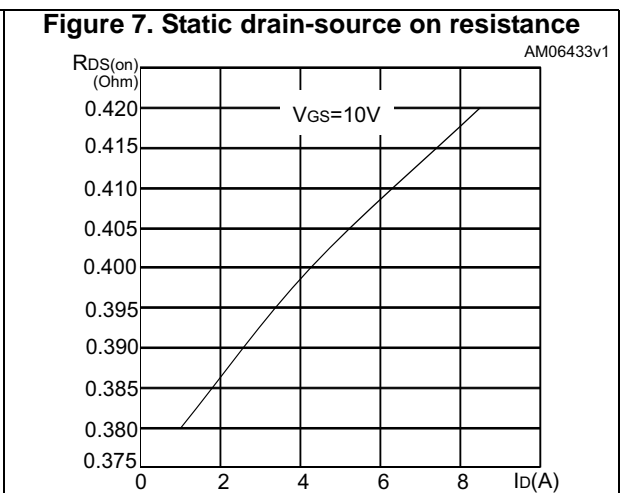
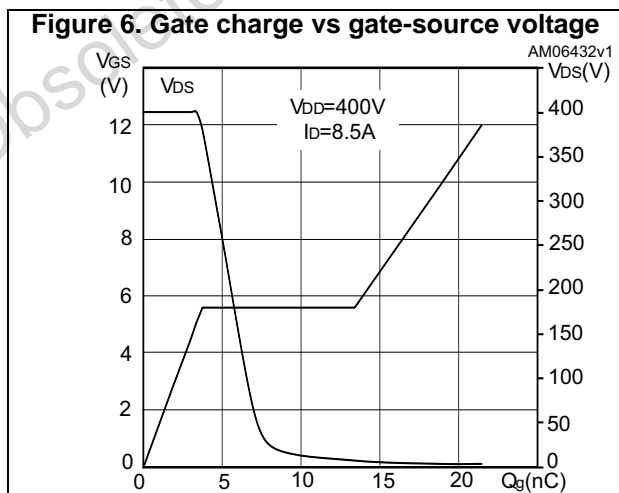
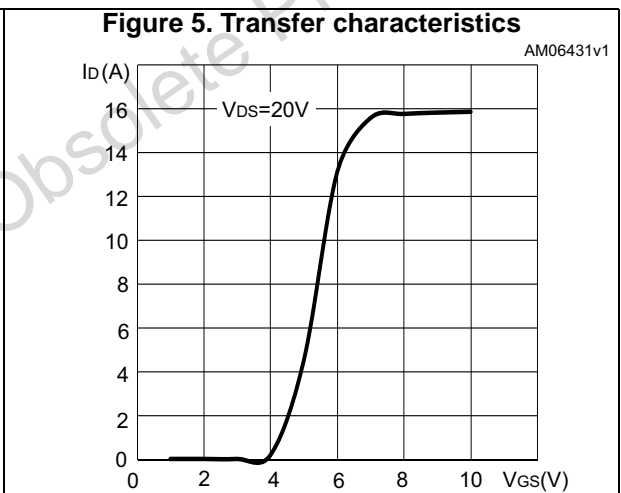
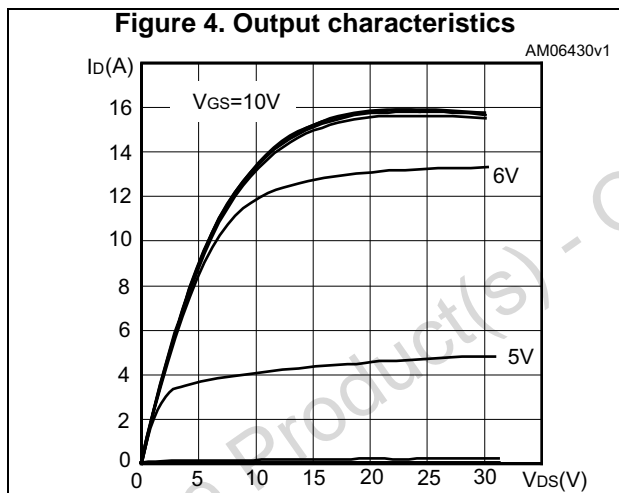
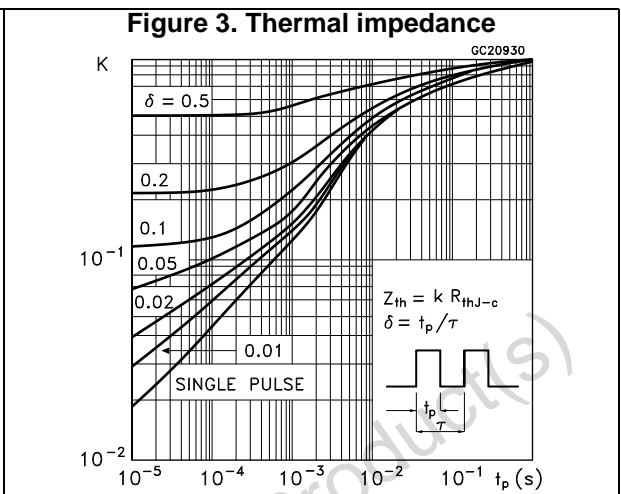
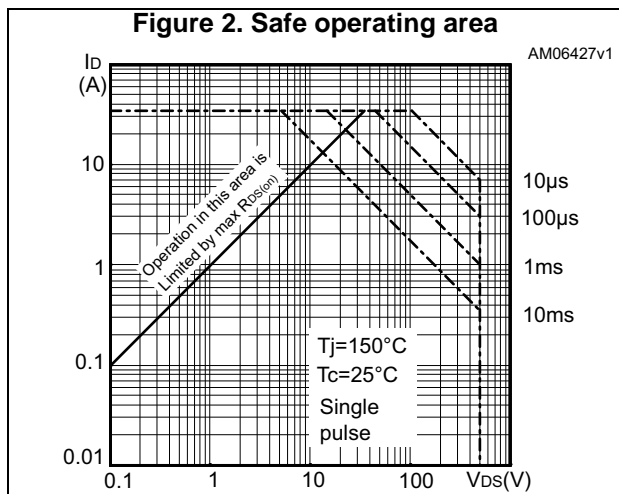
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 250\text{ V}$ , $I_D = 4.25\text{ A}$ $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15</a> and <a href="#">Figure 18</a> )	-	8	-	ns
$t_r$	Rise time		-	10	-	ns
$t_{d(off)}$	Turn-off delay time		-	33	-	ns
$t_f$	Fall time		-	10	-	ns

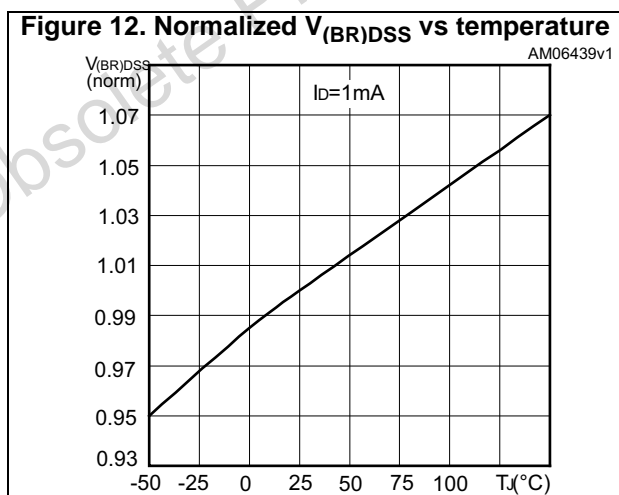
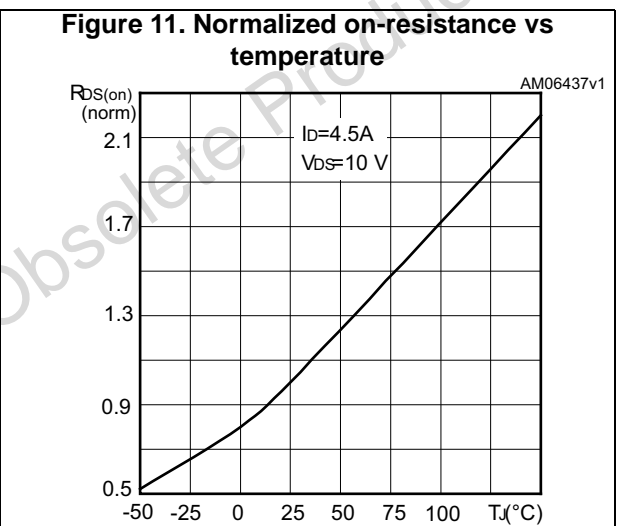
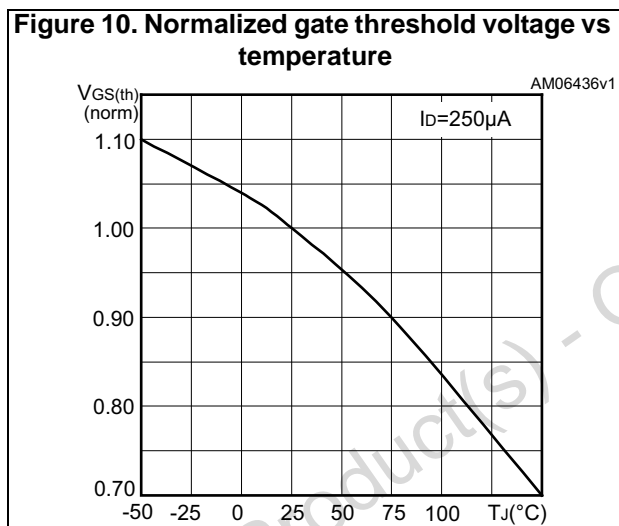
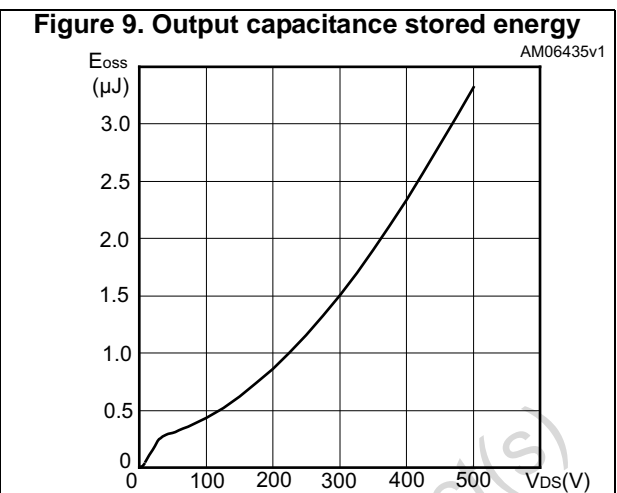
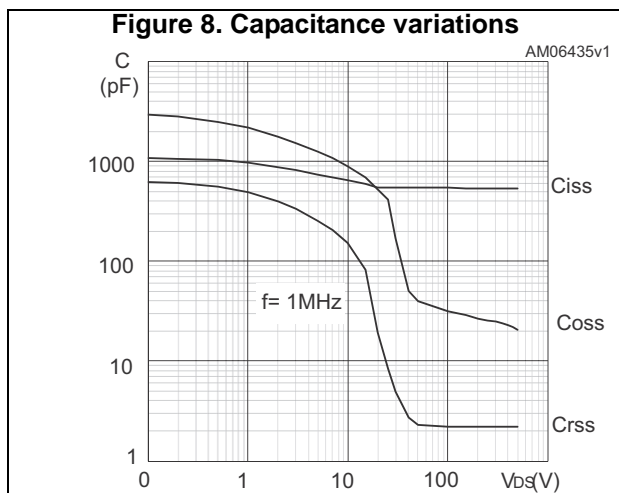
Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		8.5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				34	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 8.5\text{ A}$ , $V_{GS} = 0$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 8.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$	-	230		ns
$Q_{rr}$	Reverse recovery charge		-	2.1		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	$V_{DD} = 60\text{ V}$ (see <a href="#">Figure 15</a> )	-	18		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 8.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$	-	275		ns
$Q_{rr}$	Reverse recovery charge		-	2.5		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	$V_{DD} = 60\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ (see <a href="#">Figure 15</a> )	-	18		A

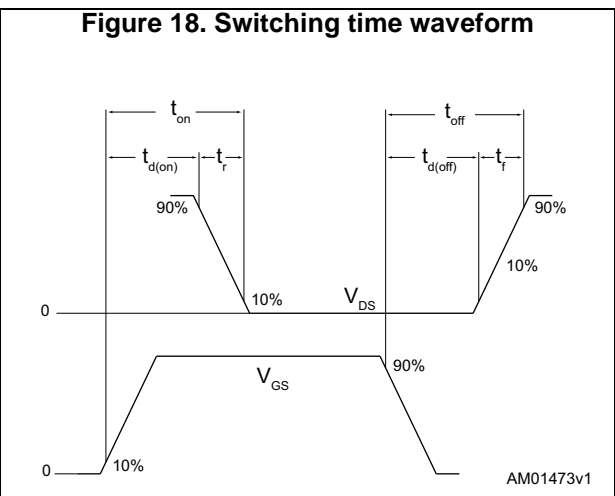
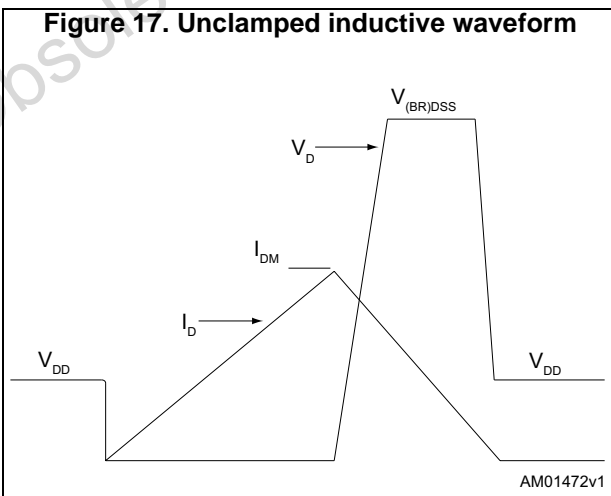
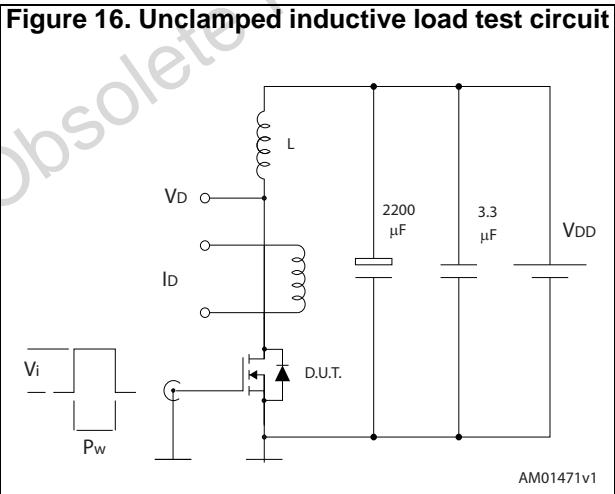
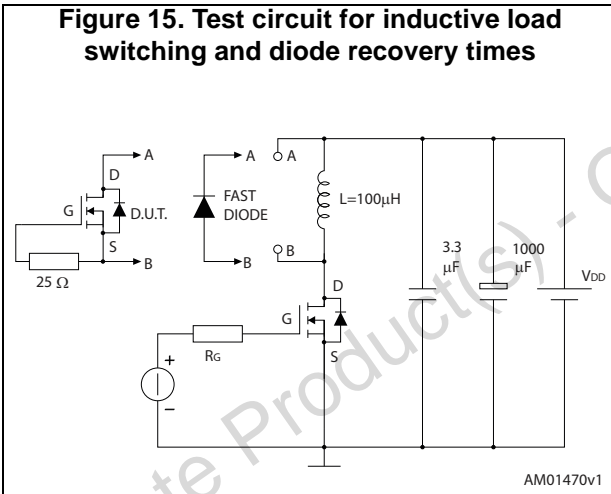
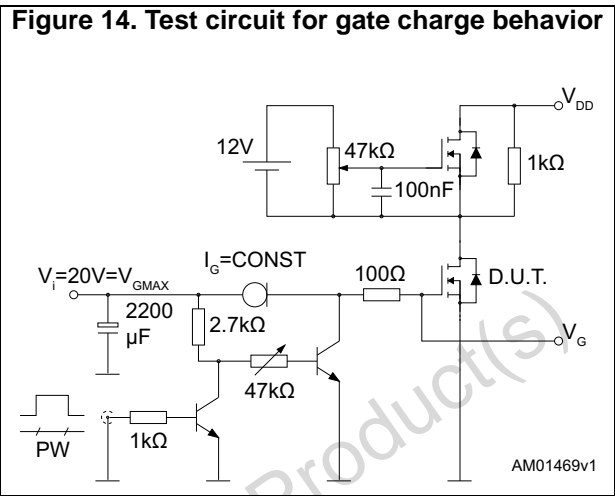
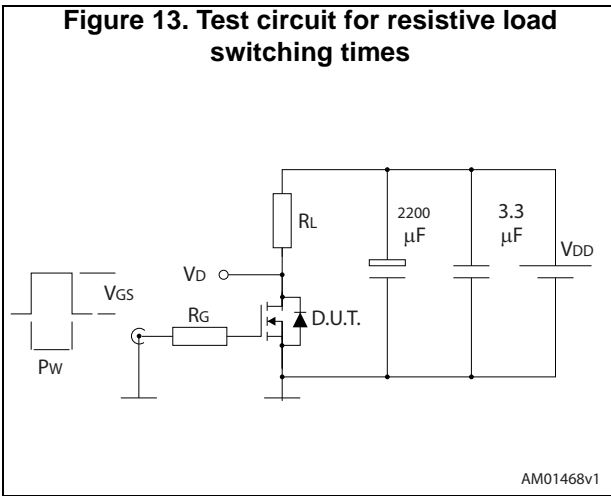
1. Pulse width limited by safe operating area.
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)





### 3 Test circuits





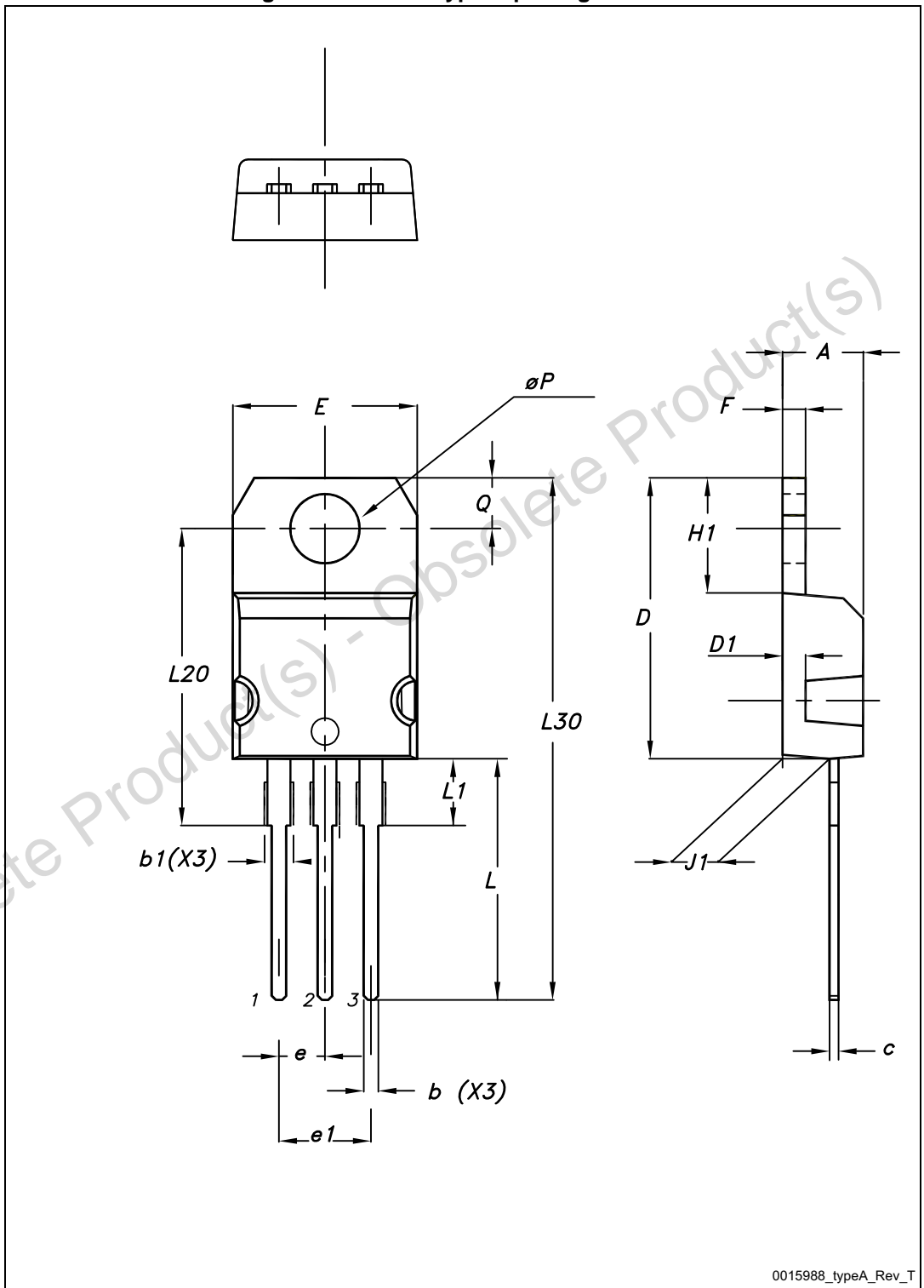
## 4 Package information

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 is an ST trademark.

Obsolete Product(s) - Obsolete Product(s)

### 4.1 TO-220 type A package information

Figure 19. TO-220 type A package outline



0015988\_typeA\_Rev\_T

Table 9. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95

## 5 Revision history

Table 10. Document revision history

Date	Revision	Changes
22-Feb-2010	1	First release.
26-Apr-2010	2	Updated <i>Table 8: Source drain diode</i> .
24-Nov-2010	3	New value inserted in <i>Table 6: Dynamic</i> .
24-Nov-2015	4	The part numbers STD11NM50N and STF11NM50N have been moved to separate datasheets

Obsolete Product(s) - Obsolete Product(s)

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2015 STMicroelectronics – All rights reserved

