



# STW62NM60N

N-channel 600 V, 0.04  $\Omega$  typ., 65 A, MDmesh™ II  
Power MOSFET in a TO-247 package

Datasheet – production data

## Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STW62NM60N	600 V	0.049 $\Omega$	65 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.

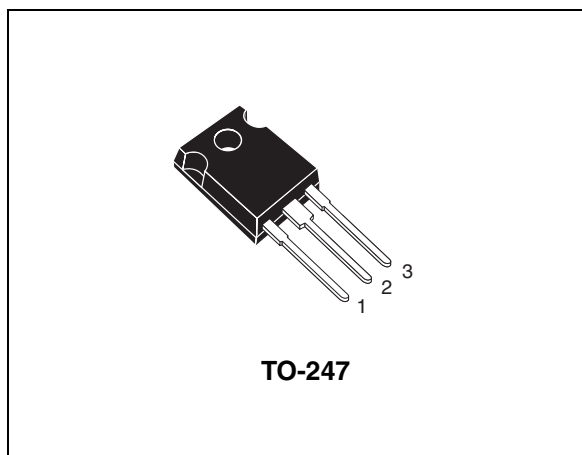


Figure 1. Internal schematic diagram

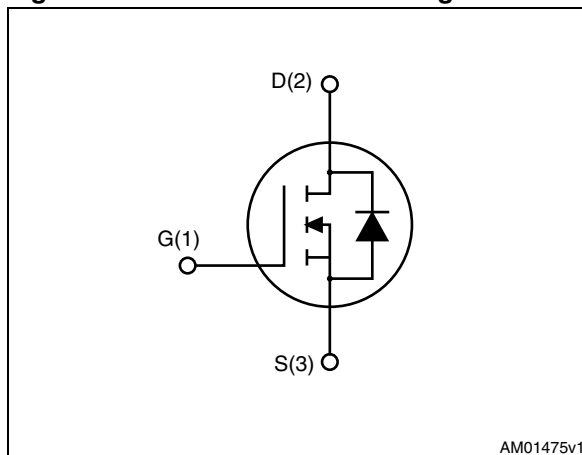


Table 1. Device summary

Order code	Marking	Package	Packaging
STW62NM60N	62NM60N	TO-247	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 mechanical data</b> .....	<b>9</b>
<b>5</b>	<b>Revision history</b> .....	<b>12</b>

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	600	V
$V_{GS}$	Gate-source voltage	$\pm 25$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	65	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	41	A
$I_{DM}^{(1)}$	Drain current (pulsed)	260	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	450	W
$I_{AS}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_{j\text{max}}$ )	10	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J=25\text{ }^\circ\text{C}$ , $I_D=I_{AS}$ , $V_{DD}=50\text{ V}$ )	480	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.  $I_{SD} \leq 65\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DS\text{ peak}} \leq V_{(BR)DSS}$ ,  $V_{DD} = 80\% V_{(BR)DSS}$ .

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj\text{-case}}$	Thermal resistance junction-case max	0.28	$^\circ\text{C}/\text{W}$
$R_{thj\text{-amb}}$	Thermal resistance junction-ambient max	50	$^\circ\text{C}/\text{W}$

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}, V_{GS} = 0$	600			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 600\text{ V}$ $V_{DS} = 600\text{ V}, T_j = 125\text{ °C}$			10 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 0.1$	$\mu\text{A}$
$V_{GS(th)}$	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	$V_{GS} = 10\text{ V}, I_D = 32.5\text{ A}$		0.04	0.049	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$	-	5800	-	$\mu\text{F}$
$C_{oss}$	Output capacitance			250		
$C_{rss}$	Reverse transfer capacitance			12		
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{GS} = 0, V_{DS} = 0\text{ to }480\text{ V}$	-	1000	-	$\mu\text{F}$
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz open drain}$		2		$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 480\text{ V}, I_D = 65\text{ A},$ $V_{GS} = 10\text{ V},$ <i>(see Figure 14)</i>	-	174	-	nC
$Q_{gs}$	Gate-source charge			28		
$Q_{gd}$	Gate-drain charge			92		

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 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}, I_D = 32.5\text{ A}$ $R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ <i>(see Figure 13)</i>	-	30	-	ns
$t_r$	Rise time			35		
$t_{d(off)}$	Turn-off delay time			65		
$t_f$	Fall time			210		

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		65	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		260	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 65 \text{ A}, V_{GS} = 0$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 65 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$	-	470		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 100 \text{ V}$	-	10		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	(see Figure 15)	-	45		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 65 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$	-	570		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 100 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$	-	15		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	(see Figure 15)	-	50		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

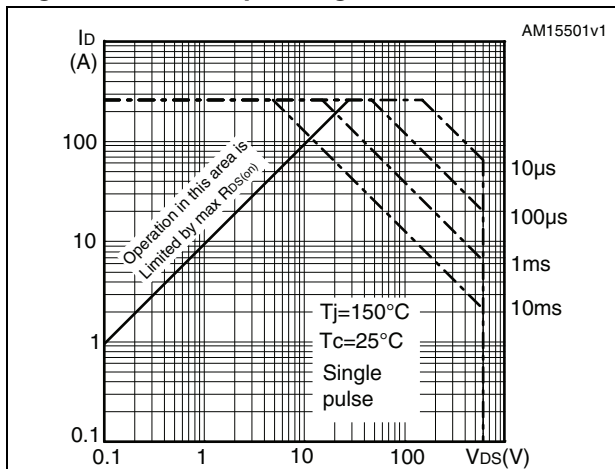


Figure 3. Thermal impedance

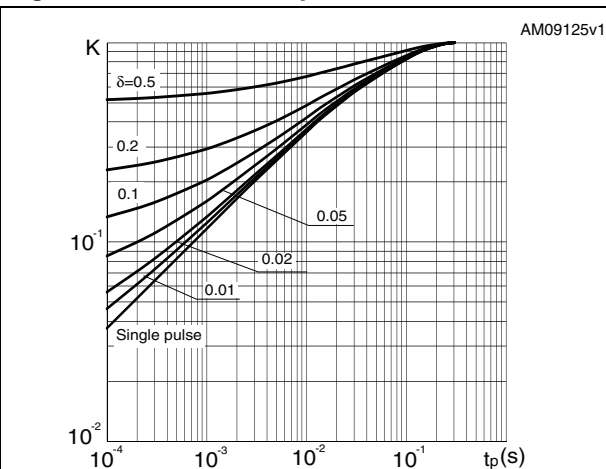


Figure 4. Output characteristics

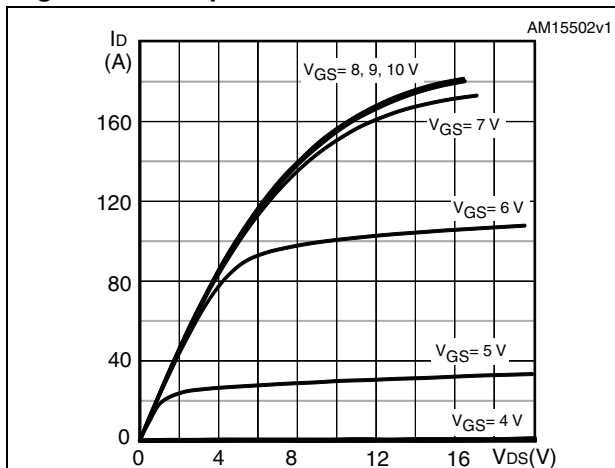


Figure 5. Transfer characteristics

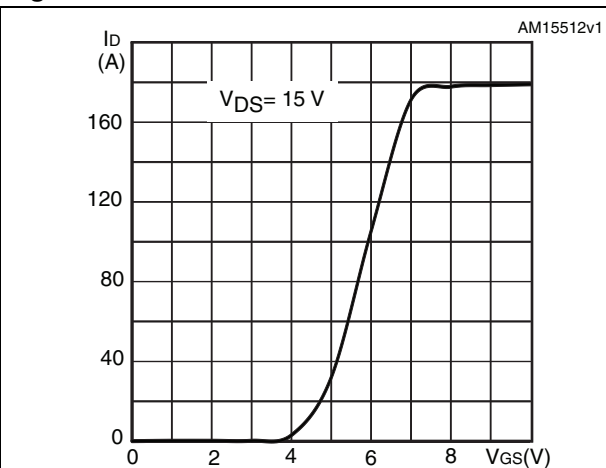


Figure 6. Gate charge vs gate-source voltage

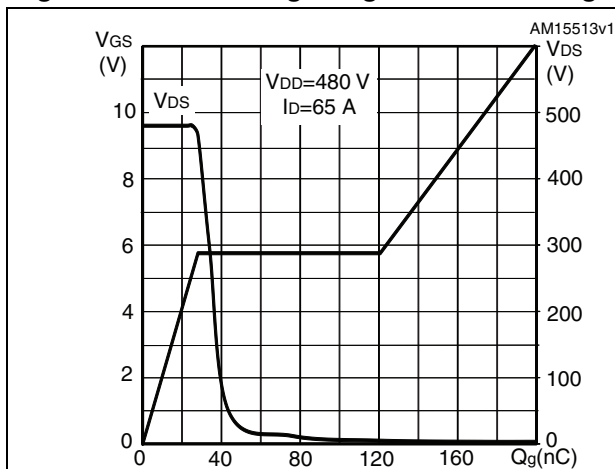


Figure 7. Static drain-source on-resistance

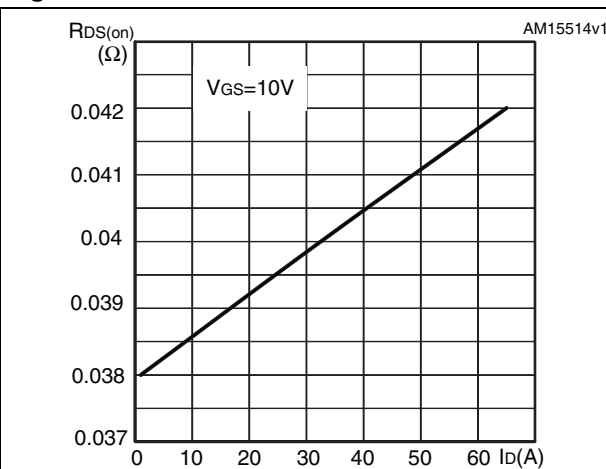


Figure 8. Capacitance variations

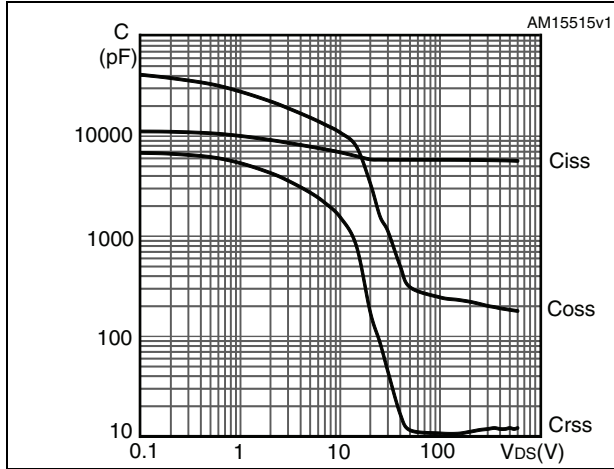


Figure 9. Source-drain diode forward characteristics

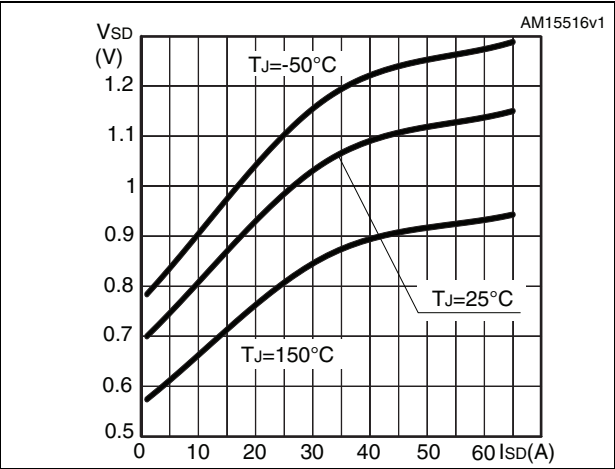


Figure 10. Normalized gate threshold voltage vs temperature

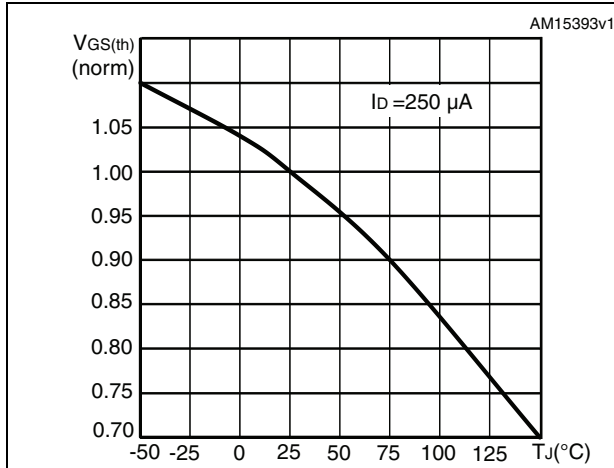


Figure 11. Normalized on-resistance vs temperature

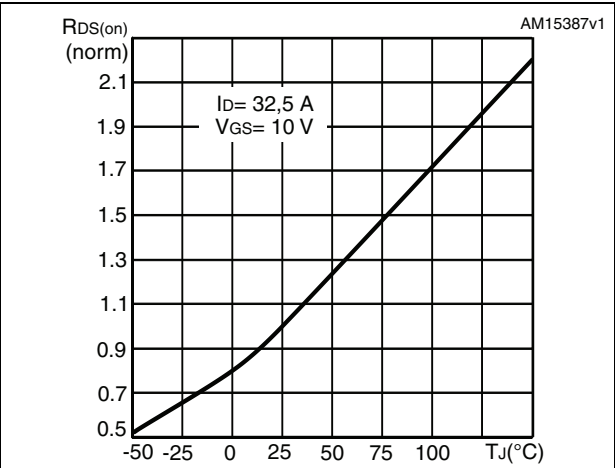
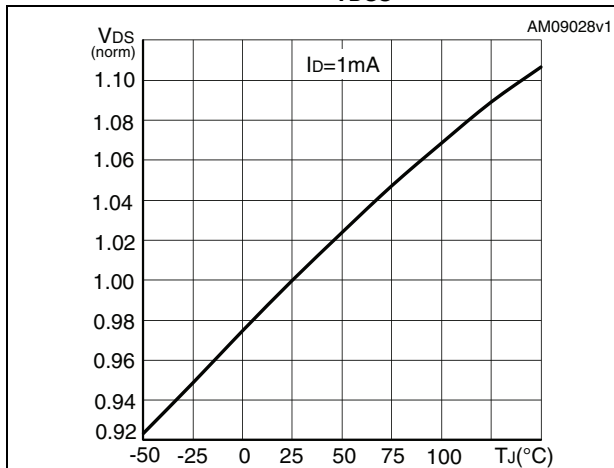


Figure 12. Normalized B<sub>VDS</sub> vs temperature

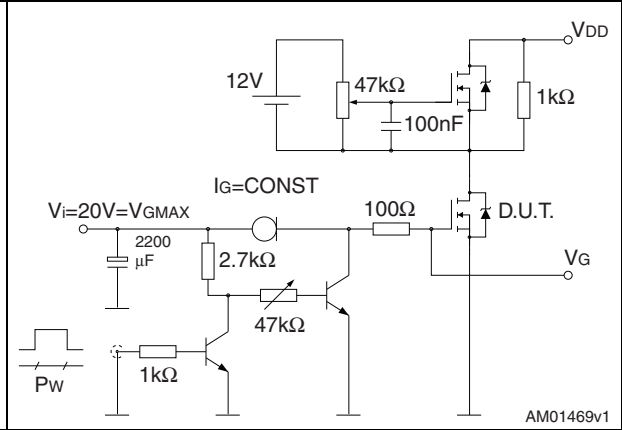


### 3 Test circuits

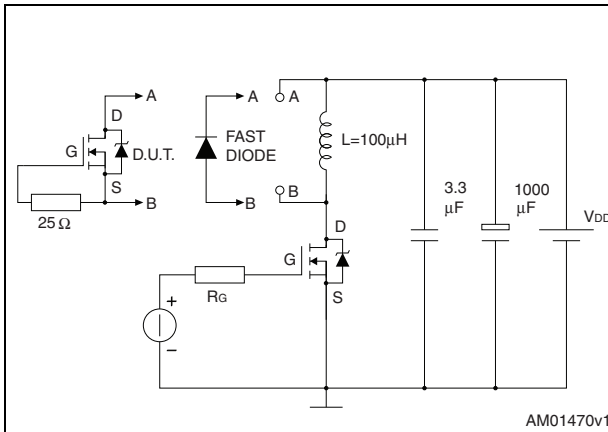
**Figure 13. Switching times test circuit for resistive load**



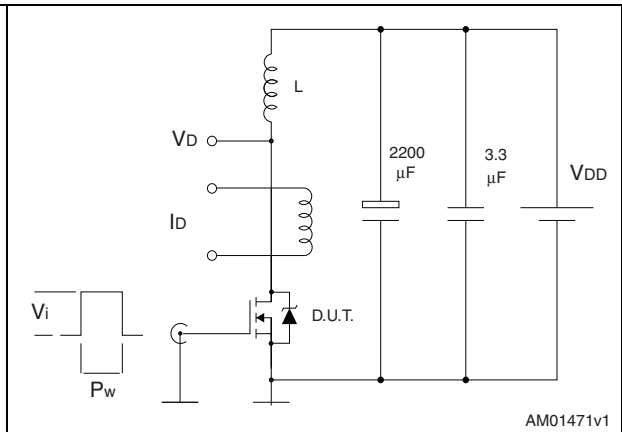
**Figure 14. Gate charge test circuit**



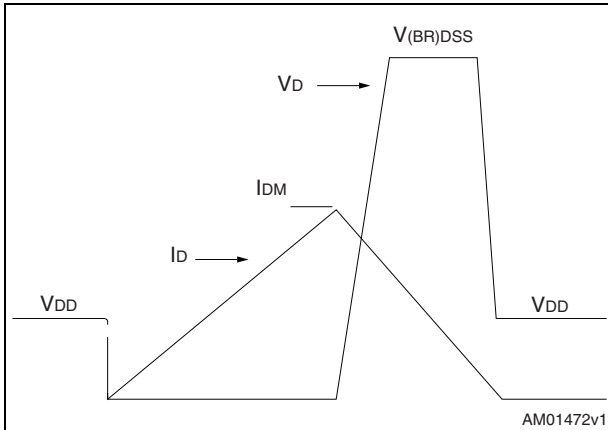
**Figure 15. Test circuit for inductive load switching and diode recovery times**



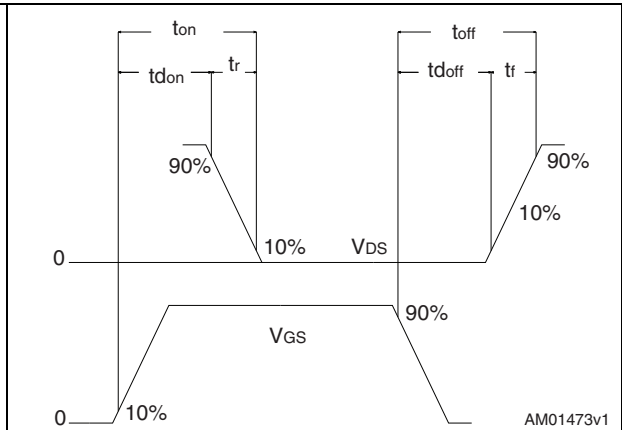
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**





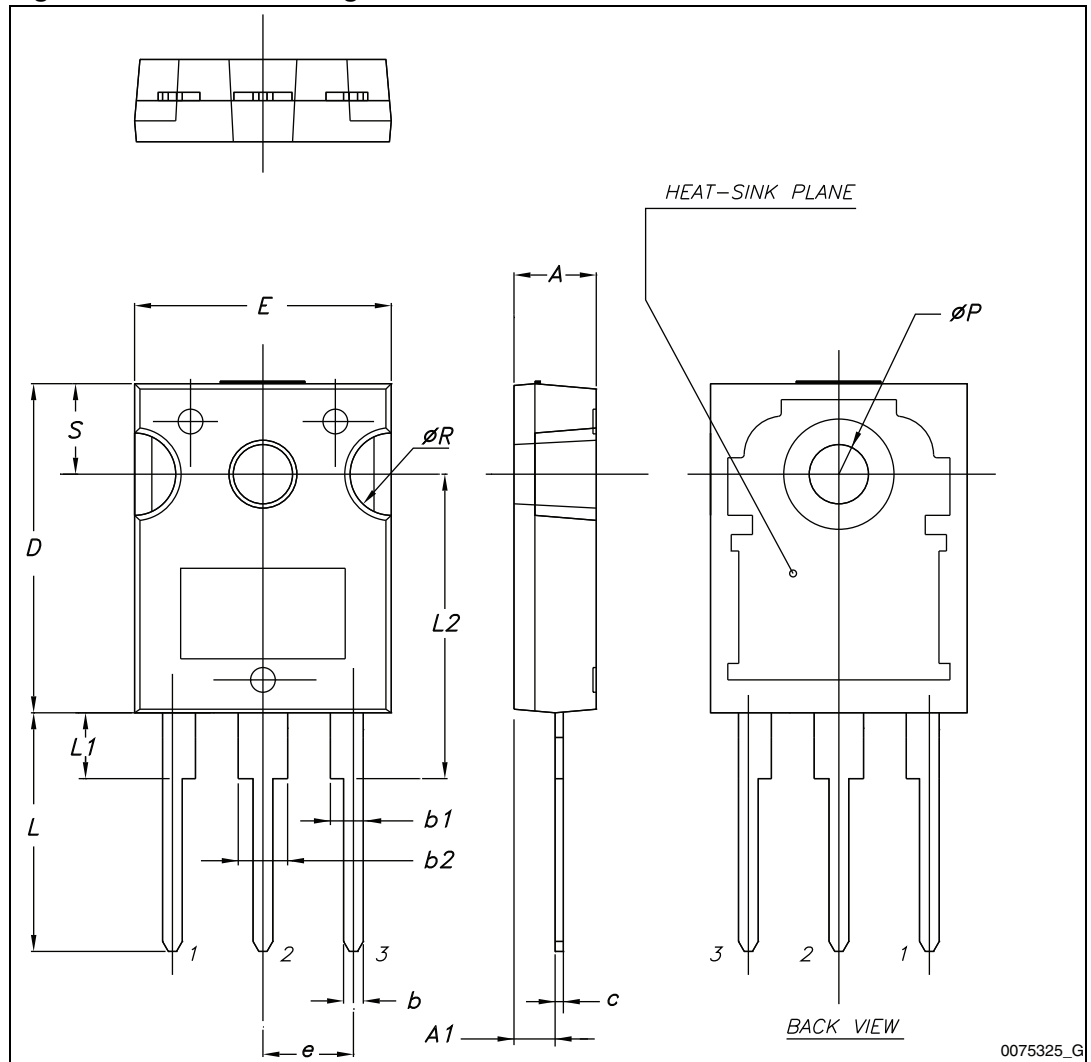
## 4 Package mechanical data

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 8. TO-247 mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70

Figure 19. TO-247 drawing



## 5 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
27-Jun-2011	1	First release.
14-Jul-2011	2	$R_{DS(on)}$ value has been corrected.
19-Dec-2012	3	<ul style="list-style-type: none"> <li>– Minor text changes</li> <li>– Document status promoted from preliminary to production data</li> <li>– Modified: <math>R_{DS(on)max}</math> and <math>I_D</math> values</li> <li>– Modified: <math>I_D</math>, <math>I_{DM}</math>, <math>P_{TOT}</math>, <math>I_{AS}</math> values and <a href="#">note 2</a> on <a href="#">Table 2</a></li> <li>– Modified: <math>R_{\theta jcase}</math> on <a href="#">Table 3</a>, <math>I_{GSS}</math> max value, <math>V_{GS}</math> typical value on <a href="#">Table 4</a></li> <li>– Modified: max and typical values on <a href="#">Table 7</a></li> <li>– Inserted: <a href="#">Section 2.1: Electrical characteristics (curves)</a></li> </ul>

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