

## N-channel 600 V, 0.03 $\Omega$ typ., 68 A MDmesh™ M2 Power MOSFET in a TO247-4 package

Datasheet - production data

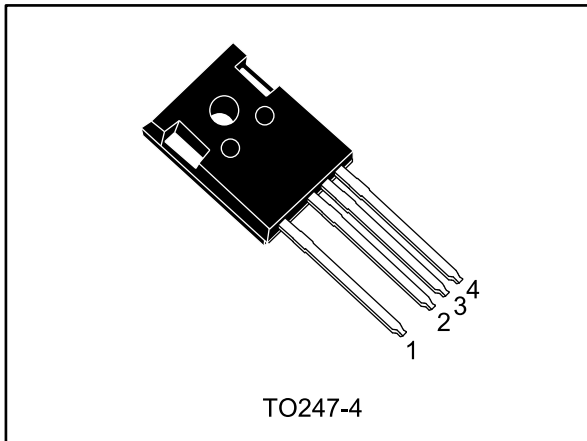
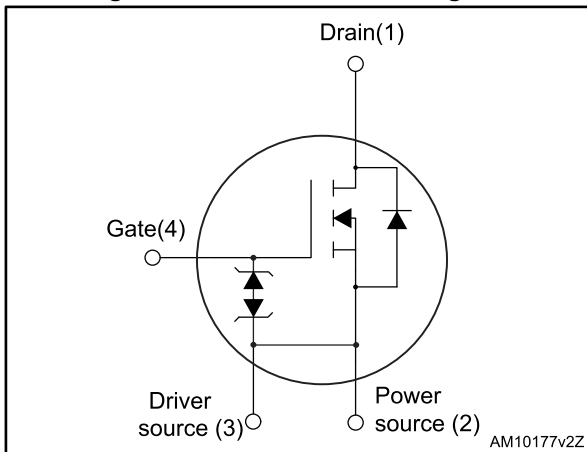


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub> @ T <sub>Jmax</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STW70N60M2-4	650 V	0.040 $\Omega$	68 A

- Excellent switching performance thanks to the extra driving source pin
- Extremely low gate charge
- Excellent output capacitance (C<sub>oss</sub>) profile
- 100% avalanche tested
- Zener-protected

### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using MDmesh™ M2 technology. Thanks to its strip layout and an improved vertical structure, the device exhibits low on-resistance and optimized switching characteristics, rendering it suitable for the most demanding high efficiency converters.

Table 1: Device summary

Order code	Marking	Package	Packaging
STW70N60M2-4	70N60M2	TO247-4	Tube

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## 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 (curve).....	6
<b>3</b>	<b>Test circuits .....</b>	<b>8</b>
<b>4</b>	<b>Package information .....</b>	<b>9</b>
	4.1 TO247-4 package information.....	9
<b>5</b>	<b>Revision history .....</b>	<b>11</b>

# 1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V <sub>GS</sub>	Gate-source voltage	±25	V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25 °C	68	A
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 100 °C	43	A
I <sub>DM</sub> <sup>(1)</sup>	Drain current (pulsed)	272	A
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25 °C	450	W
I <sub>AR</sub>	Avalanche current, repetitive or not repetitive (pulse width limited by T <sub>jmax</sub> )	10	A
E <sub>AS</sub>	Single pulse avalanche energy (starting T <sub>j</sub> =25°C, I <sub>D</sub> = 10 A; V <sub>DD</sub> =50 V)	1500	mJ
dv/dt <sup>(2)</sup>	Peak diode recovery voltage slope	15	V/ns
dv/dt <sup>(3)</sup>	MOSFET dv/dt ruggedness	50	V/ns
T <sub>stg</sub>	Storage temperature range	- 55 to 150	°C
T <sub>j</sub>	Operating junction temperature range		

**Notes:**

<sup>(1)</sup>Pulse width limited by safe operating area

<sup>(2)</sup>I<sub>SD</sub> ≤ 68 A, di/dt = 400 A/μs, V<sub>DS(peak)</sub> < V<sub>(BR)DSS</sub>, V<sub>DD</sub> = 400 V

<sup>(3)</sup>V<sub>DS</sub> ≤ 480 V

Table 3: Thermal data

Symbol	Parameter	Value	Unit
R <sub>thj-case</sub>	Thermal resistance junction-case max	0.28	°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-ambient max	50	°C/W

## 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	$I_D = 1\text{ mA}$ , $V_{GS} = 0$	600			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0$ , $V_{DS} = 600\text{ V}$			1	$\mu\text{A}$
		$V_{GS} = 0$ , $V_{DS} = 600\text{ V}$ , $T_C = 125\text{ °C}$ <sup>(1)</sup>			100	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0$ , $V_{GS} = \pm 25\text{ V}$			$\pm 10$	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	$V_{GS} = 10\text{ V}$ , $I_D = 34\text{ A}$		0.030	0.040	$\Omega$

**Notes:**

<sup>(1)</sup>Defined by design, not subject to production test.

**Table 5: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	5200	-	pF
$C_{oss}$	Output capacitance		-	250	-	pF
$C_{rss}$	Reverse transfer capacitance		-	5	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{GS} = 0$ , $V_{DS} = 0\text{ to }480\text{ V}$	-	395	-	pF
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz}$ , $I_D = 0\text{ A}$	-	3.3	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 480\text{ V}$ , $I_D = 68\text{ A}$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15: "Gate charge test circuit"</a> )	-	118	-	nC
$Q_{gs}$	Gate-source charge		-	25	-	nC
$Q_{gd}$	Gate-drain charge		-	47	-	nC

**Notes:**

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

**Table 6: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$ , $I_D = 34\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 14: "Switching times test circuit for resistive load"</a> and <a href="#">Figure 19: "Switching time waveform"</a> )	-	30	-	ns
$t_r$	Rise time		-	10	-	ns
$t_{d(off)}$	Turn-off-delay time		-	150	-	ns
$t_f$	Fall time		-	9	-	ns

Table 7: Source drain diode

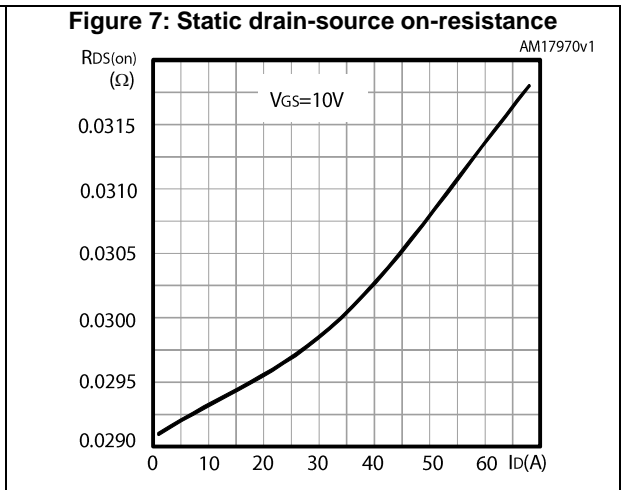
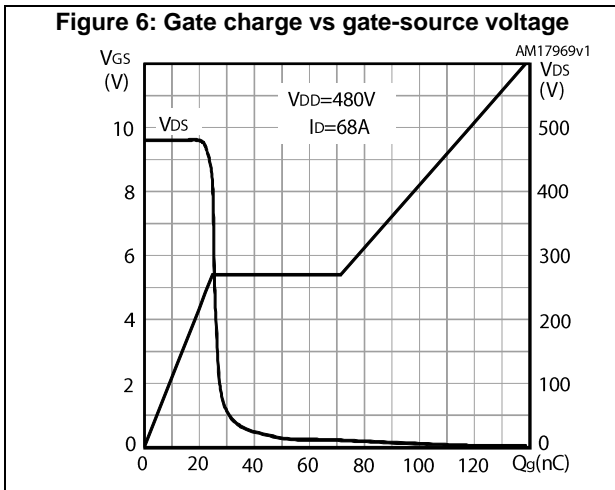
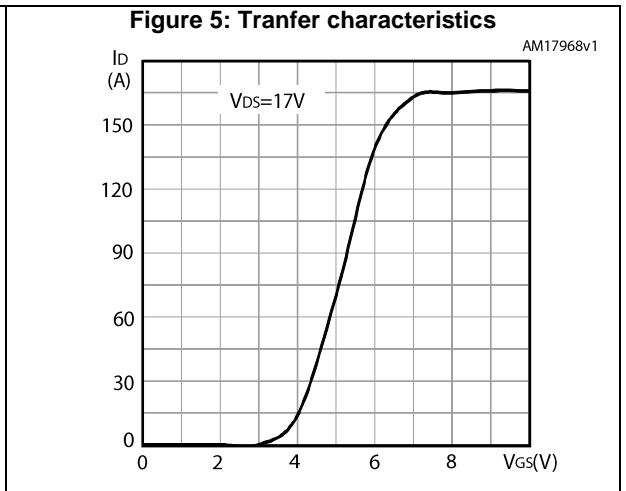
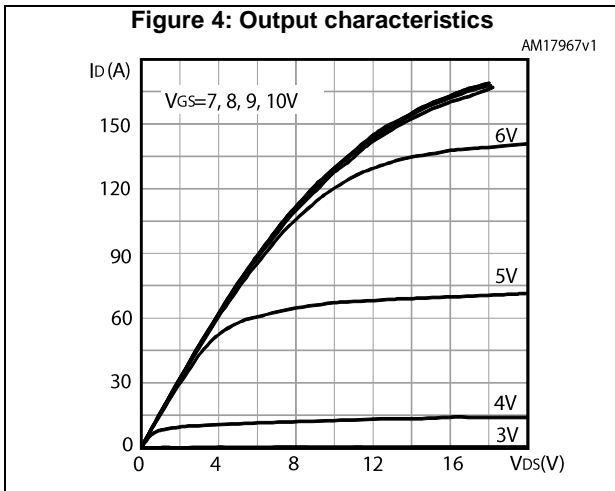
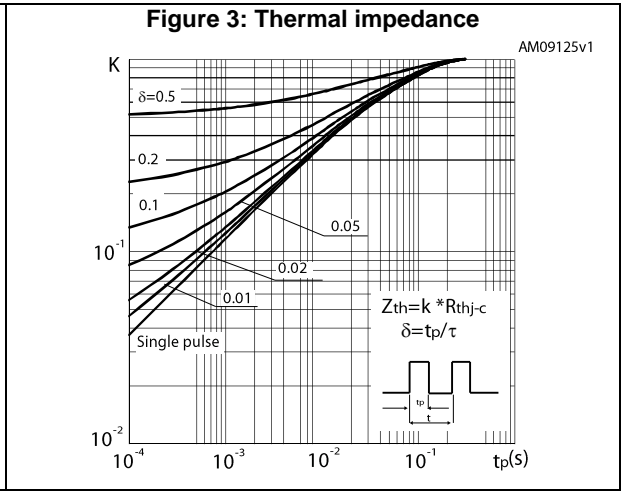
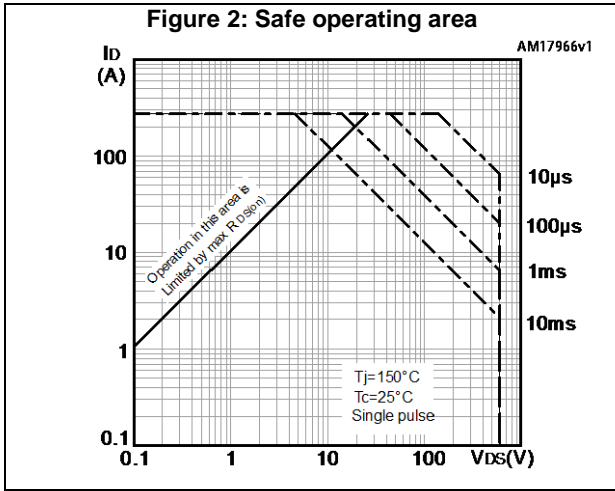
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		68	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		272	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 68 \text{ A}$ , $V_{GS} = 0$	-	0.98	1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 68 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$ (see <a href="#">Figure 18: "Unclamped inductive waveform"</a> )	-	520		ns
$Q_{rr}$	Reverse recovery charge		-	12		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	45		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 68 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$ , $T_j = 150 \text{ }^\circ\text{C}$ (see <a href="#">Figure 18: "Unclamped inductive waveform"</a> )	-	680		ns
$Q_{rr}$	Reverse recovery charge		-	18		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	50		A

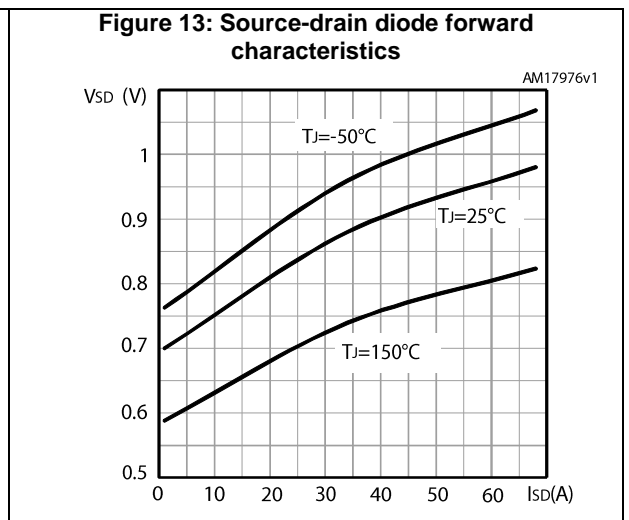
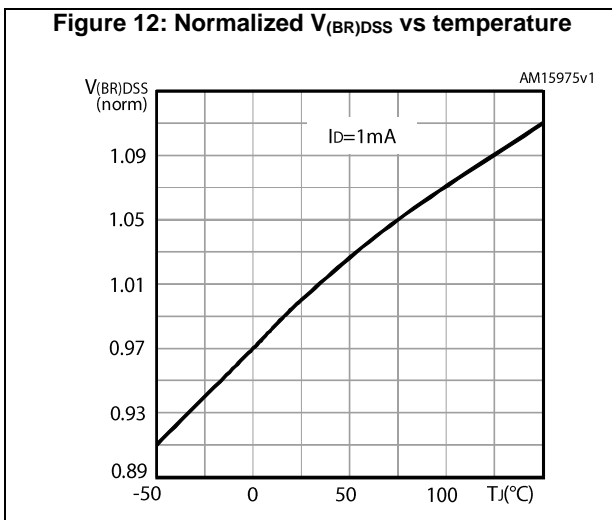
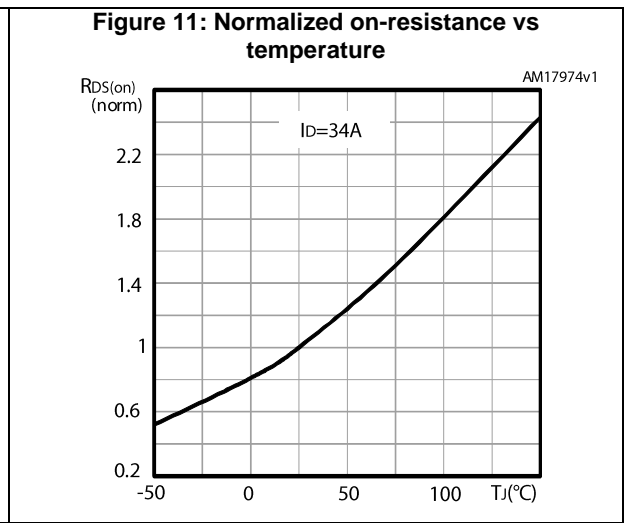
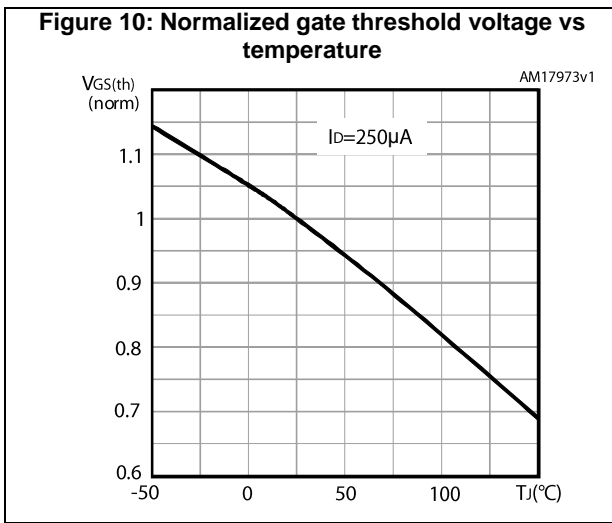
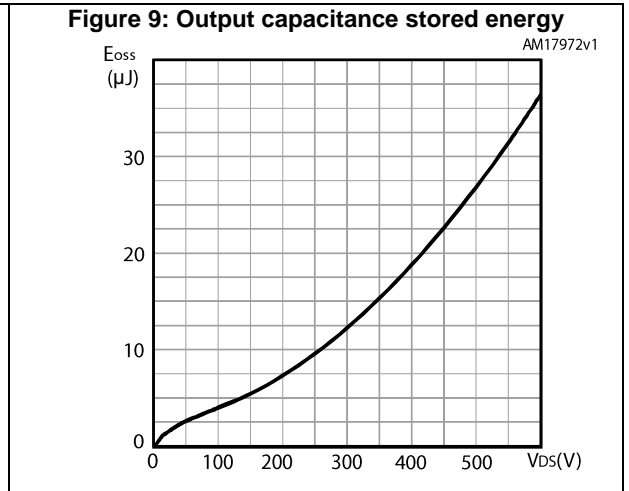
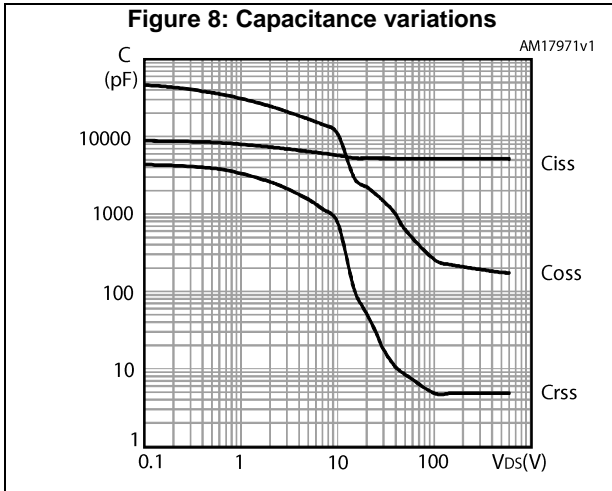
**Notes:**

(1)Pulse width limited by safe operating area

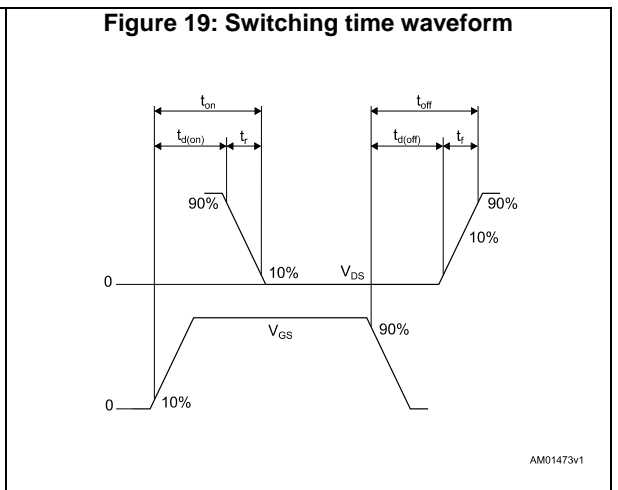
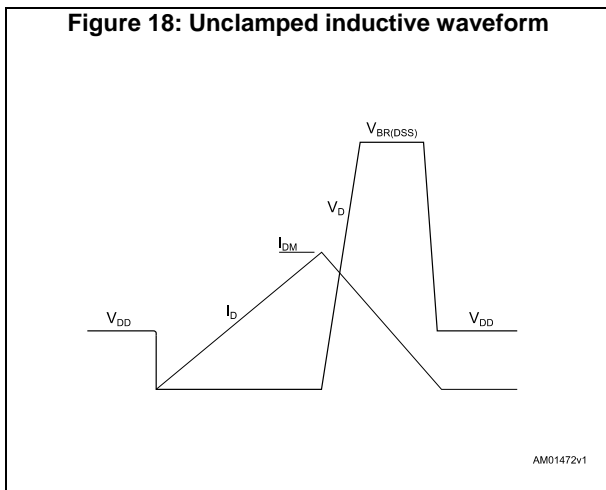
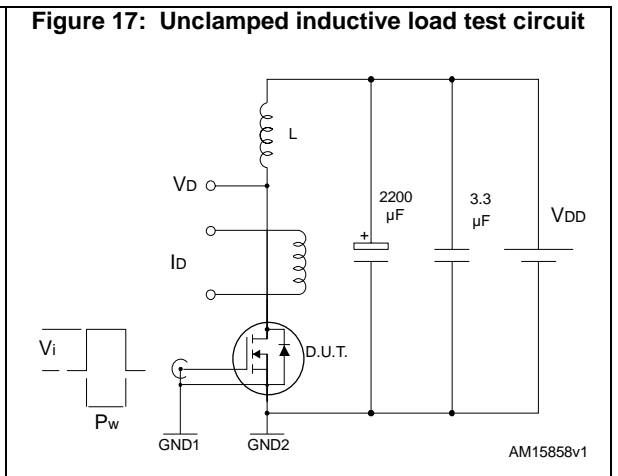
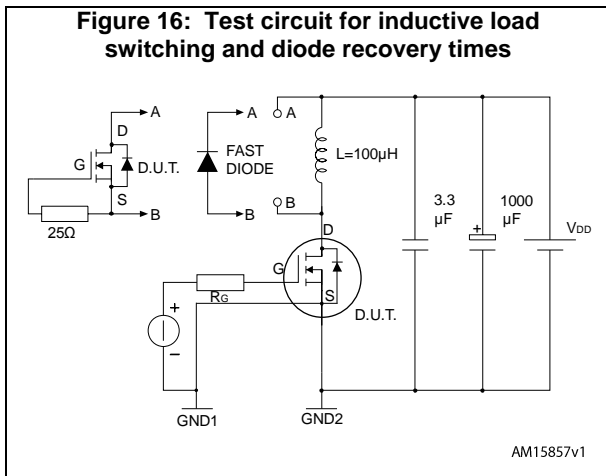
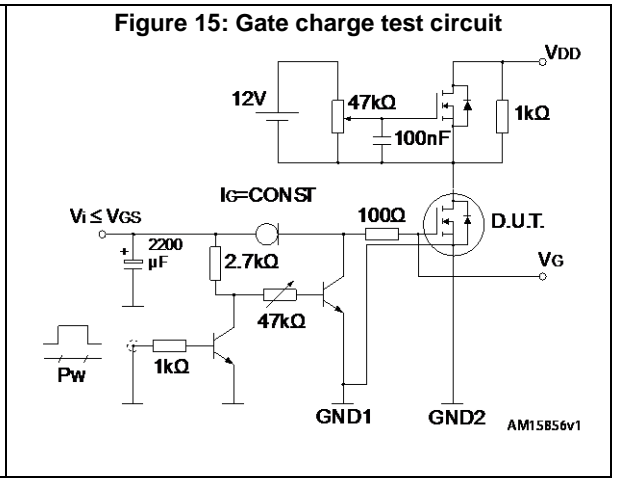
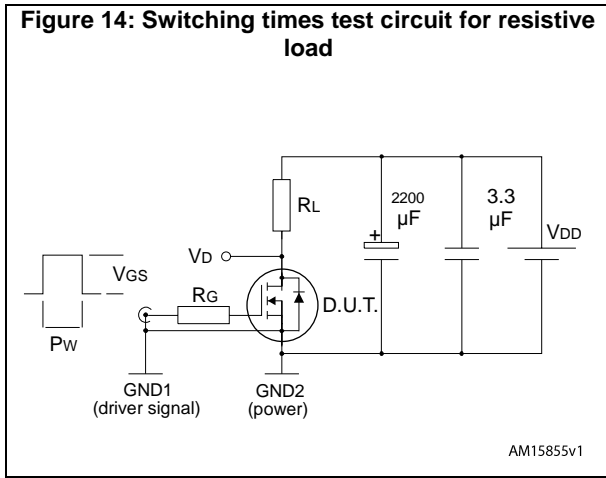
(2)Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curve)





### 3 Test circuits





## 4 Package information

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](http://www.st.com). ECOPACK® is an ST trademark.

### 4.1 TO247-4 package information

Figure 20: TO247-4 package outline

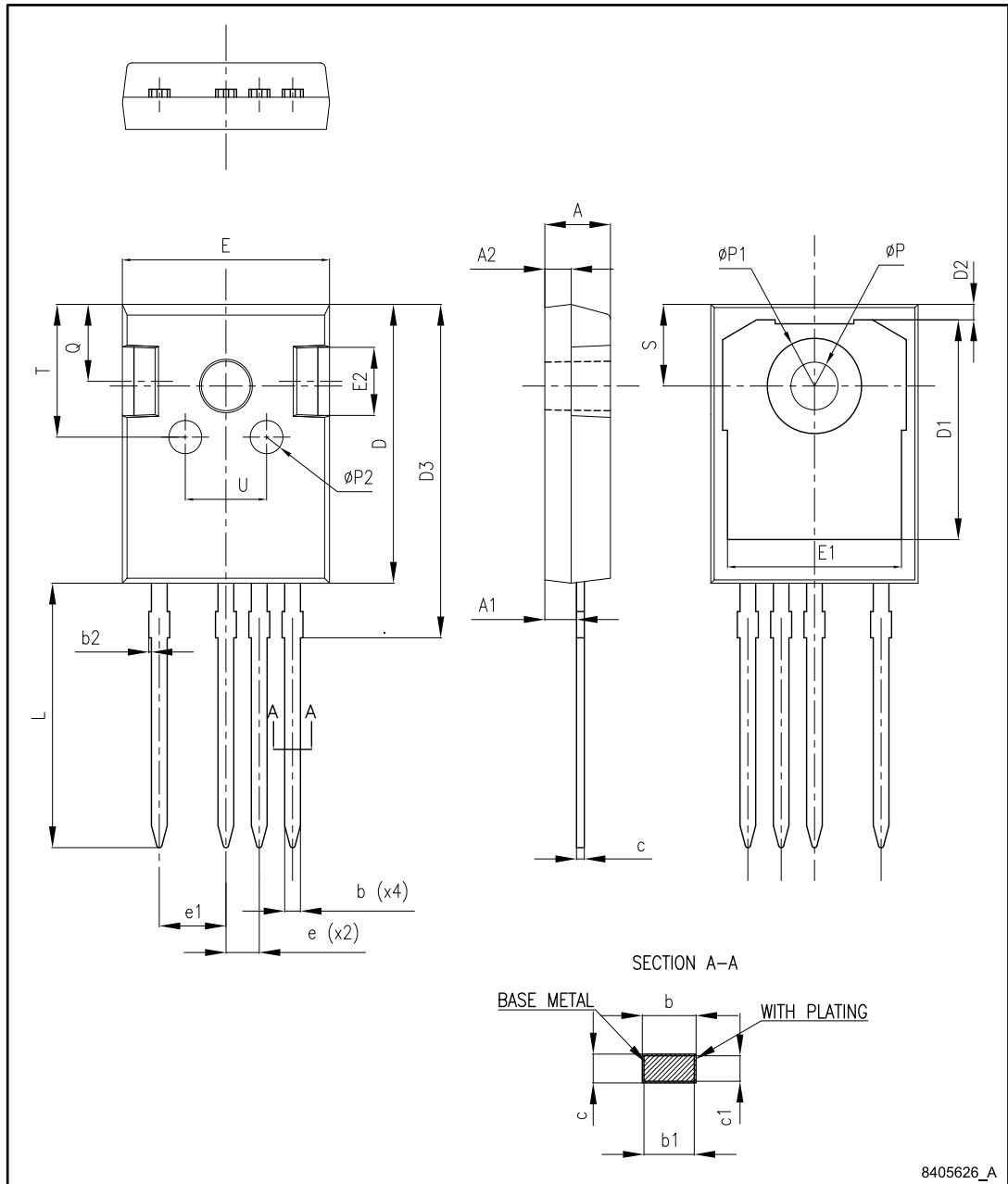


Table 8: TO247-4 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
b	1.16		1.29
b1	1.15	1.20	1.25
b2	0		0.20
c	0.59		0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
D3	24.97	25.12	25.27
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	2.44	2.54	2.64
e1	4.98	5.08	5.18
L	19.80	19.92	20.10
P	3.50	3.60	3.70
P1			7.40
P2	2.40	2.50	2.60
Q	5.60		6.00
S		6.15	
T	9.80		10.20
U	6.00		6.40

## 5 Revision history

Table 9: Document revision history

Date	Revision	Changes
26-Sep-2016	1	Initial release.

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