

## N-channel 600 V, 0.06 $\Omega$ typ., 42 A MDmesh™ M2 Power MOSFET in a TO247-4 package

Datasheet - production data

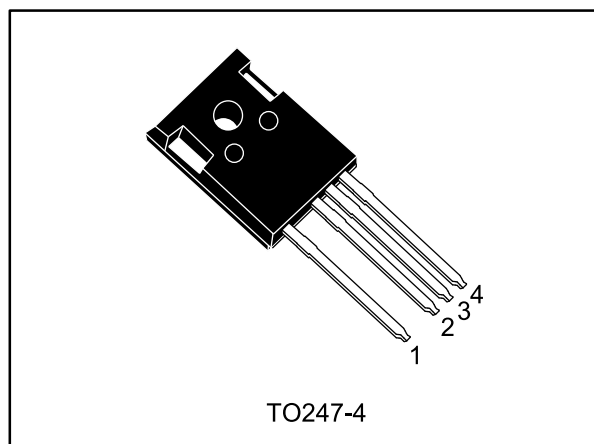
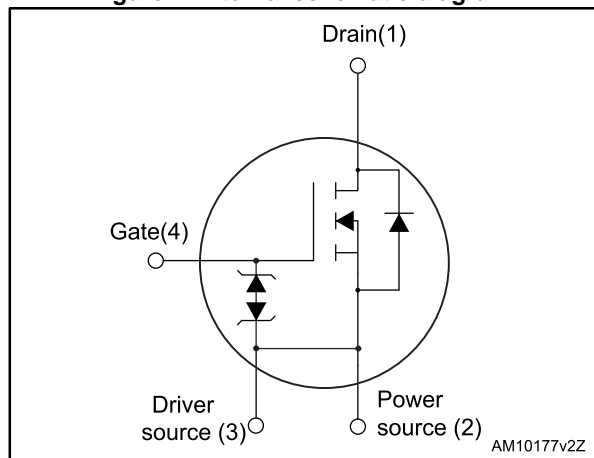


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub> @ T <sub>Jmax</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STW48N60M2-4	650 V	0.07 $\Omega$	42 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

- High efficiency switching applications:
  - Servers
  - PV inverters
  - Telecom infrastructure
  - Multi kW battery chargers

### 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
STW48N60M2-4	48N60M2	TO247-4	Tube

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# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate- source voltage	$\pm 25$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	42	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	26	A
$I_{DM}^{(1)}$	Drain current (pulsed)	168	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	300	W
$I_{AR}$	Max current during repetitive or single pulse avalanche (pulse width limited by $T_{JMAX}$ )	7	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	4500	mJ
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
$dv/dt^{(3)}$	MOSFET $dv/dt$ ruggedness	50	V/ns
$T_{stg}$	Storage temperature	- 55 to 150	$^\circ\text{C}$
$T_j$	Max. operating junction temperature	150	$^\circ\text{C}$

**Notes:**

(1) Pulse width limited by safe operating area

(2)  $I_{SD} \leq 42\text{ A}$ ,  $di/dt = 400\text{ A}/\mu\text{s}$ ,  $V_{DS(peak)} < V_{(BR)DSS}$ ,  $V_{DD} = 400\text{ V}$

(3)  $V_{DS} \leq 480\text{ V}$

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.42	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	50	$^\circ\text{C}/\text{W}$

## 2 Electrical characteristics

( $T_C = 25\text{ }^\circ\text{C}$  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	$\mu\text{A}$
		$V_{DS} = 600\text{ V}$ , $T_C = 125\text{ }^\circ\text{C}$			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	$V_{GS} = 10\text{ V}$ , $I_D = 21\text{ A}$		0.06	0.07	$\Omega$

**Table 5: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	3060	-	pF
$C_{oss}$	Output capacitance		-	143	-	pF
$C_{riss}$	Reverse transfer capacitance		-	4.3	-	pF
$C_{o(er)}^{(1)}$	Equivalent Output Capacitance	$V_{GS} = 0$ , $V_{DS} = 0$ to $480\text{ V}$	-	630	-	$\pi\Phi$
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	4.6	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 480\text{ V}$ , $I_D = 42\text{ A}$ , $V_{GS} = 10\text{ V}$	-	70	-	nC
$Q_{gs}$	Gate-source charge		-	10.5	-	nC
$Q_{gd}$	Gate-drain charge		-	31	-	nC

**Notes:**

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

**Table 6: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$ , $I_D = 21\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$	-	18.5	-	ns
$t_r$	Rise time		-	17	-	ns
$t_{d(off)}$	Turn-off-delay time		-	13	-	ns
$t_f$	Fall time		-	119	-	ns

Table 7: Source drain diode

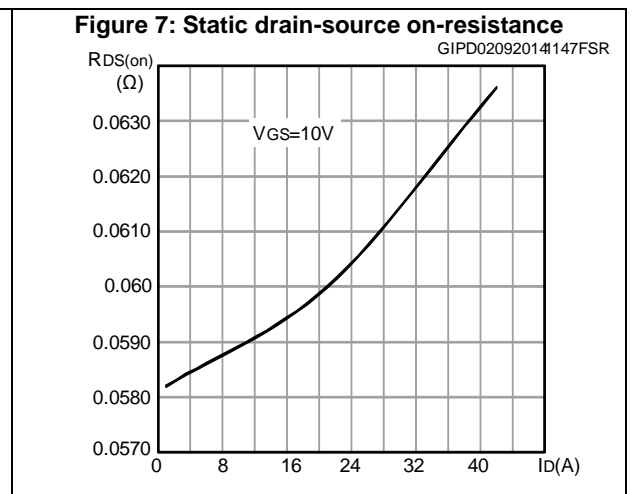
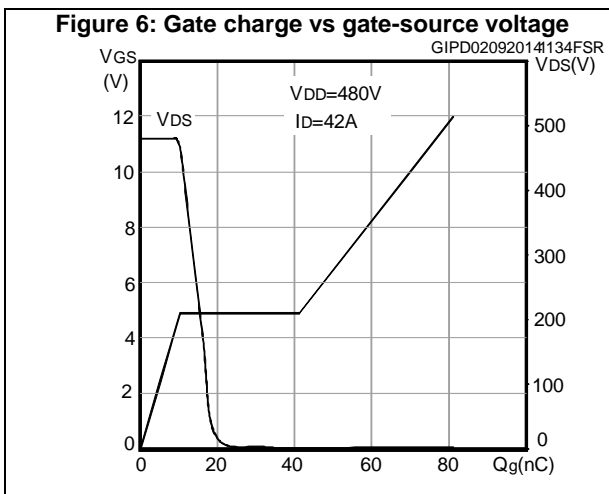
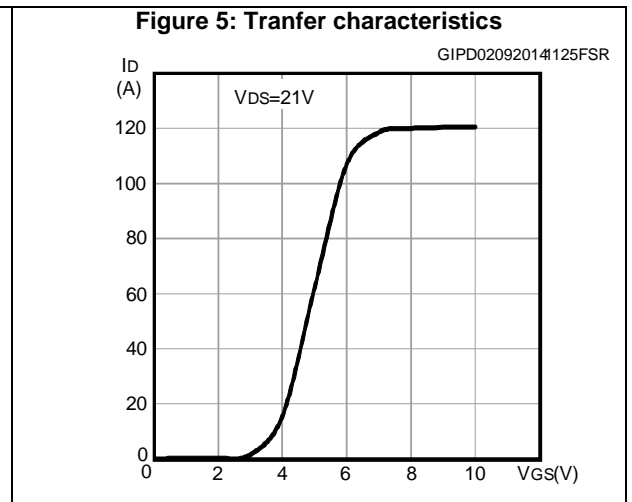
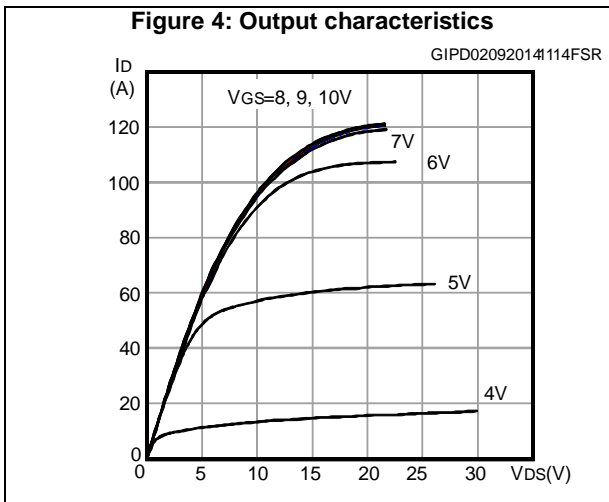
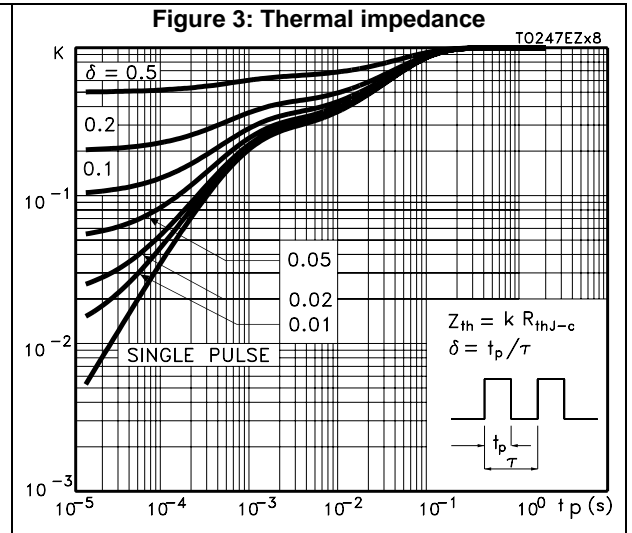
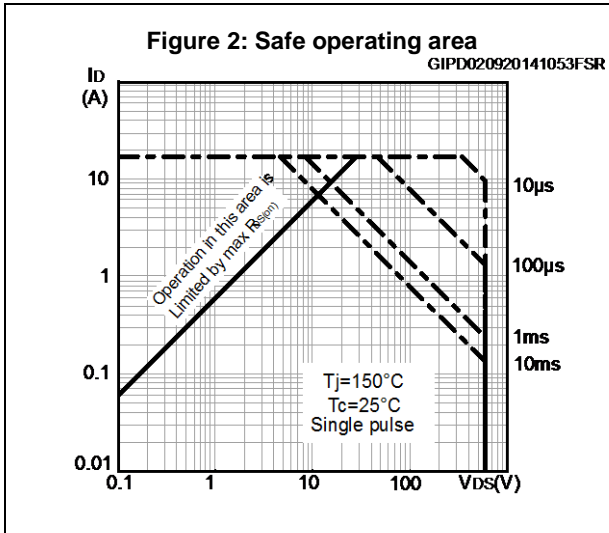
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		42	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		168	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 21\text{ A}$ , $V_{GS} = 0$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 42\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$	-	487		ns
$Q_{rr}$	Reverse recovery charge		-	9.1		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	37.5		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 42\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$	-	605		ns
$Q_{rr}$	Reverse recovery charge		-	12.5		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	41.5		A

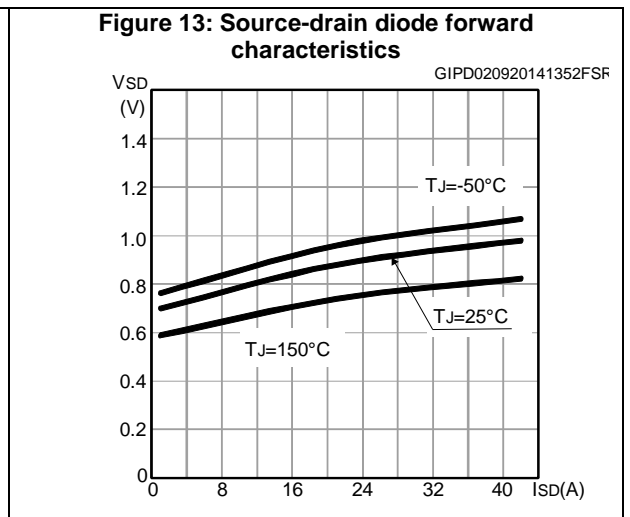
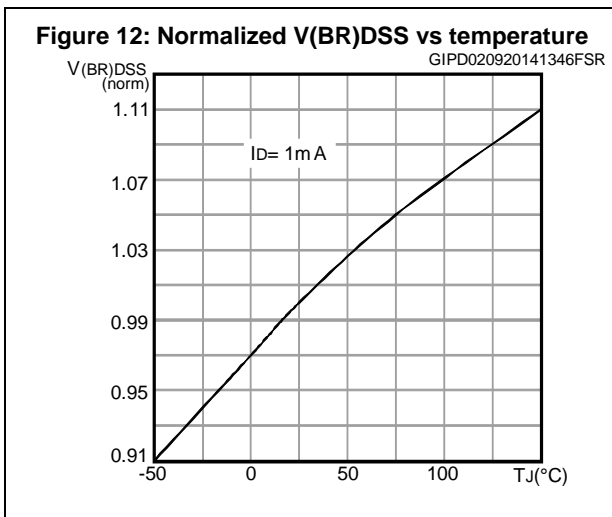
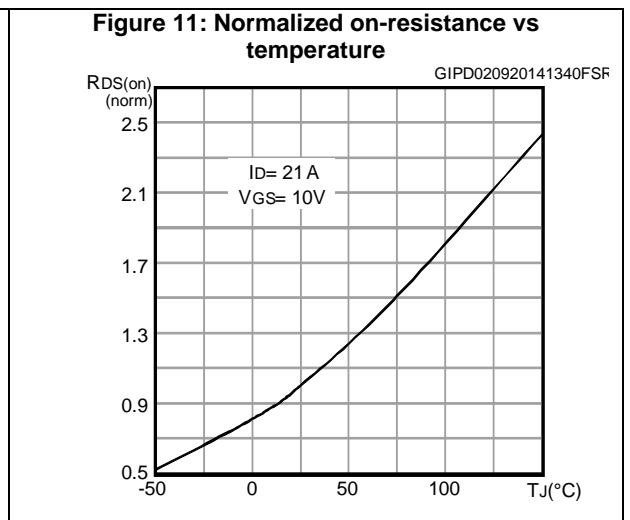
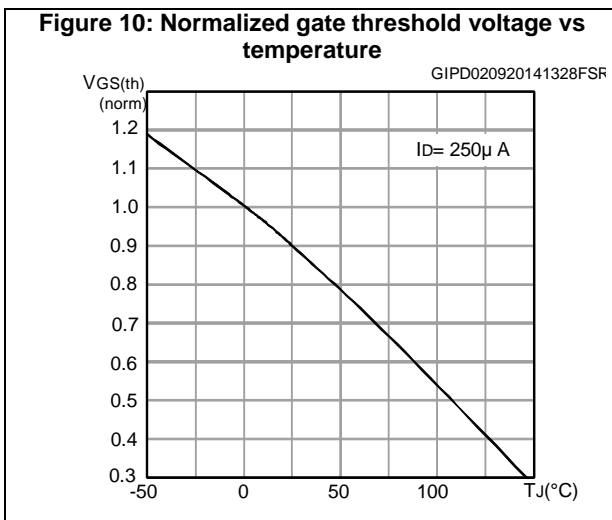
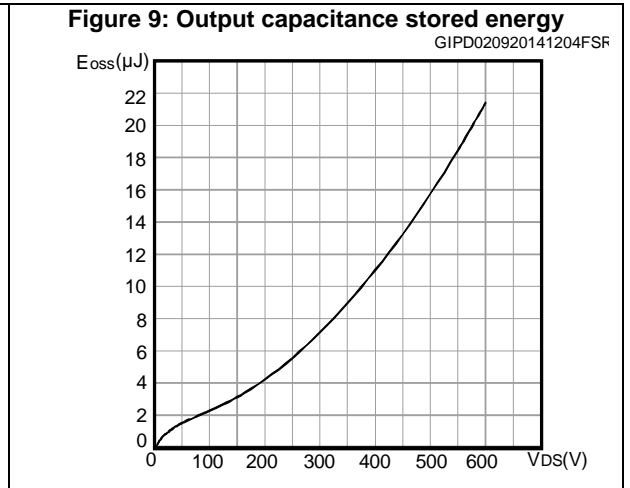
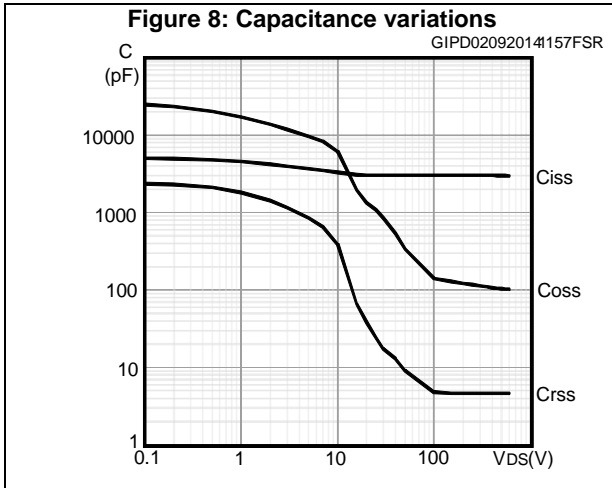
**Notes:**

(1)Pulse width limited by safe operating area

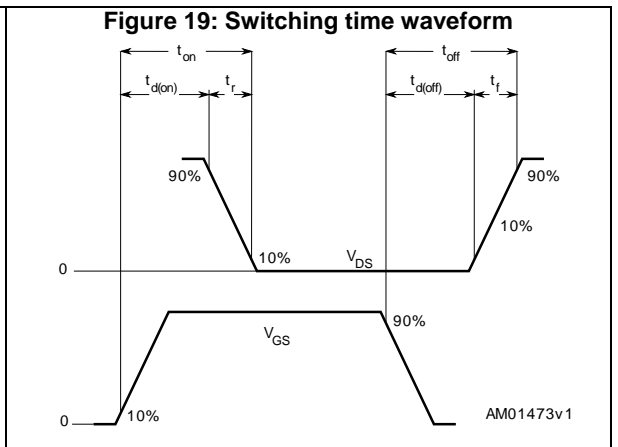
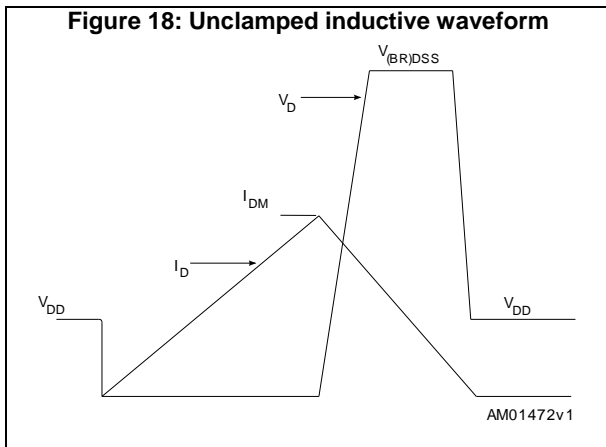
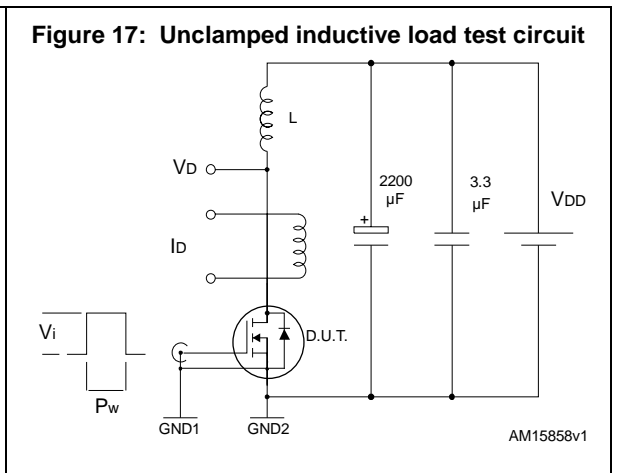
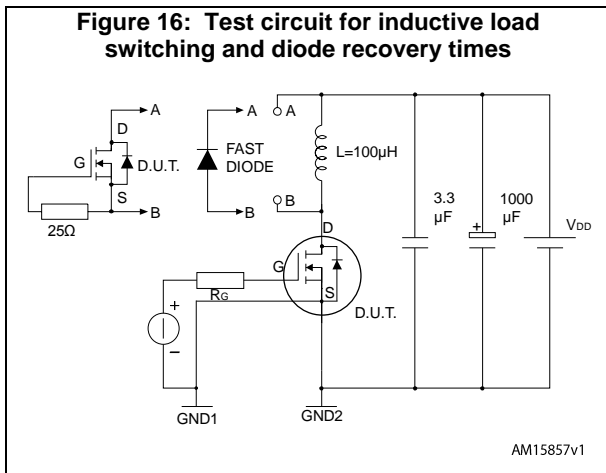
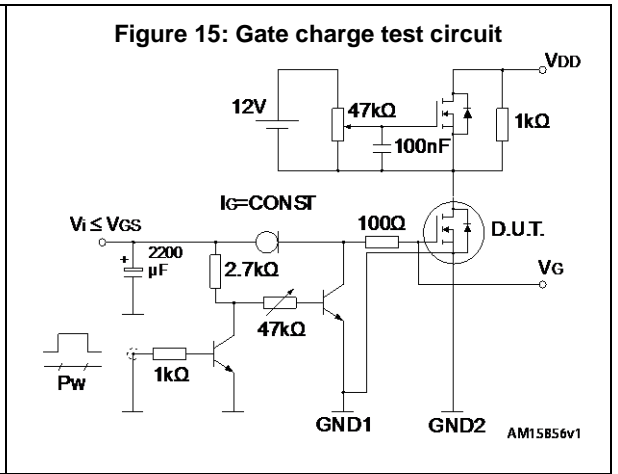
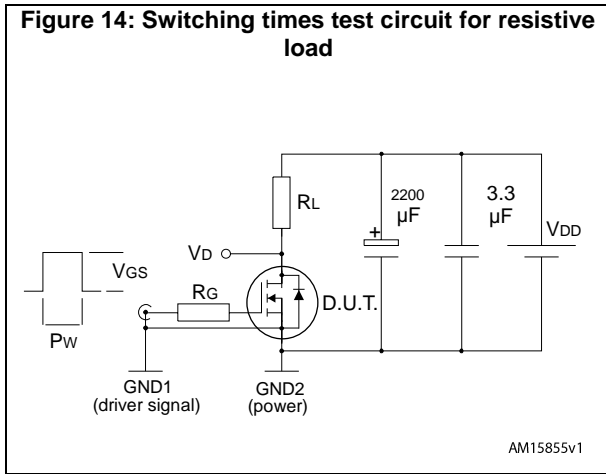
(2)Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.2 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

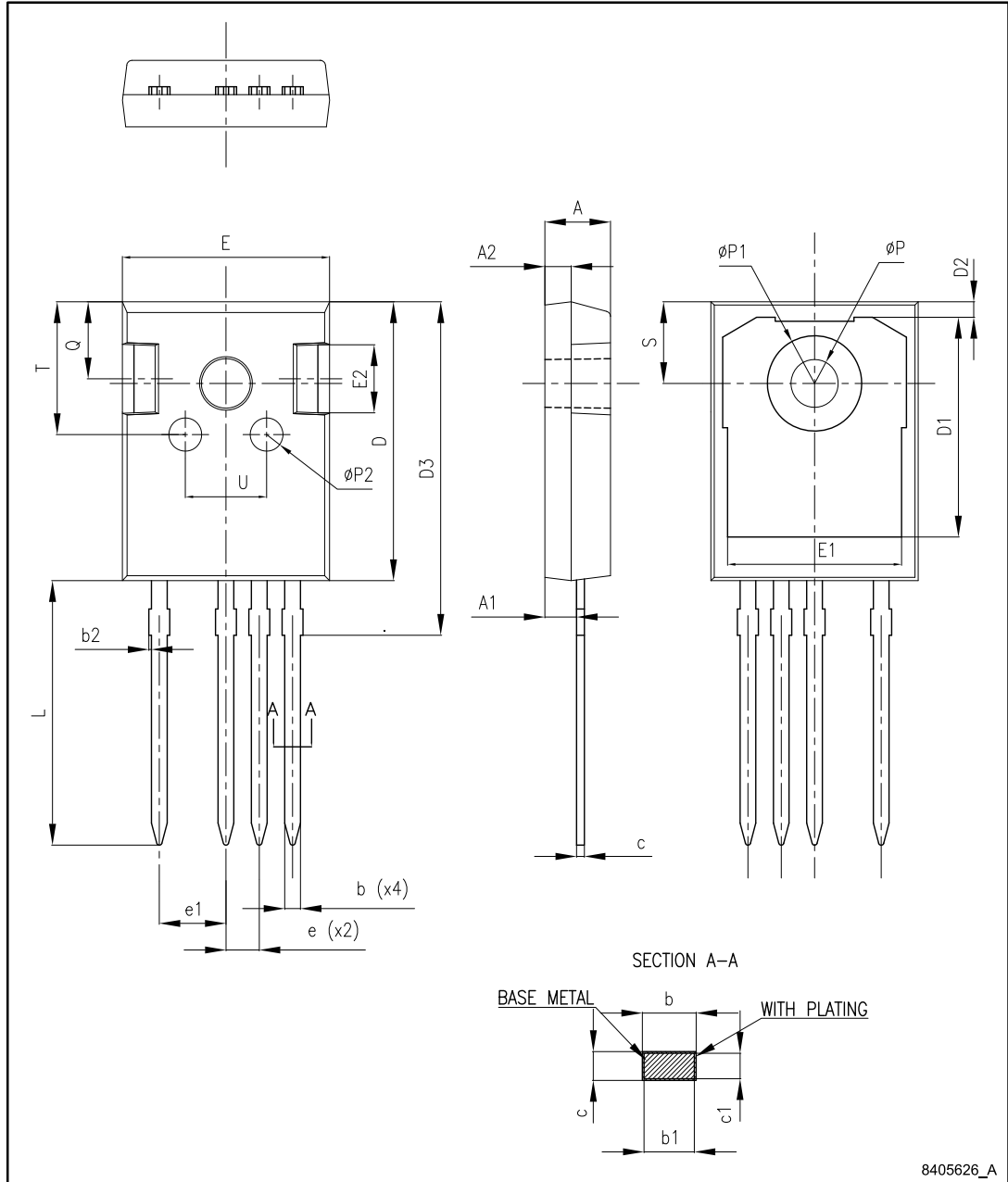


Table 8: TO247-4 mechanical data

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
25-Jul-2014	1	Initial release.
30-Jan-2015	2	Added section <a href="#">Section 2.1: "Electrical characteristics (curve)"</a>

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