

## N-channel 600 V, 85 mΩ typ., 30 A MDmesh™ M6 Power MOSFETs in TO-220 and TO-247 packages

Datasheet - production data

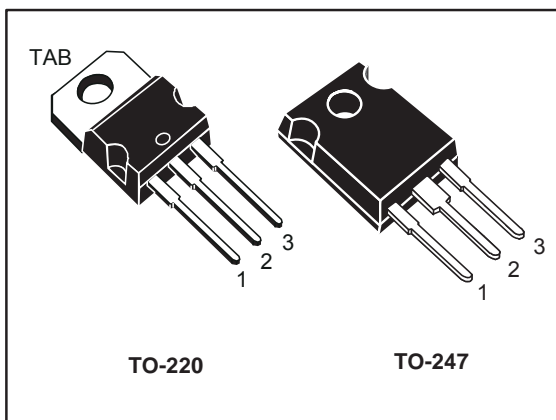
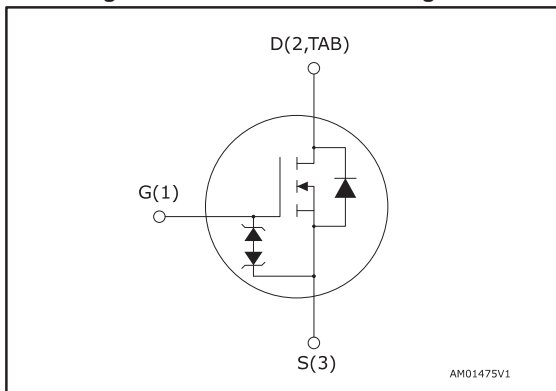


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STP36N60M6	600 V	99 mΩ	30 A
STW36N60M6			

- Reduced switching losses
- Lower R<sub>DS(on)</sub> x area vs previous generation
- Low gate input resistance
- 100% avalanche tested
- Zener-protected

### Applications

- Switching applications

### Description

The new MDmesh™ M6 technology incorporates the most recent advancements to the well-known and consolidated MDmesh family of SJ MOSFETs. STMicroelectronics builds on the previous generation of MDmesh devices through its new M6 technology, which combines excellent R<sub>DS(on)</sub> \* area improvement with one of the most effective switching behaviors available, as well as a user-friendly experience for maximum end-application efficiency.

Table 1: Device summary

Order code	Marking	Package	Packaging
STP36N60M6	36N60M6	TO-220	Tube
STW36N60M6		TO-247	

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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 $T_C = 25\text{ }^\circ\text{C}$	30	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	19	A
$I_D^{(1)}$	Drain current (pulsed)	102	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	208	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
$dv/dt^{(3)}$	MOSFET $dv/dt$ ruggedness	50	V/ns
$T_{stg}$	Storage temperature range	-55 to 150	$^\circ\text{C}$
$T_j$	Operating junction temperature range		

**Notes:**

(1) Pulse width limited by safe operating area.

(2)  $I_{SD} \leq 30\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DS(\text{peak})} < V_{(BR)DSS}$ ,  $V_{DD} = 400\text{ V}$ .

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

Table 3: Thermal data

Symbol	Parameter	Value		Unit
		TO-220	TO-247	
$R_{thj\text{-case}}$	Thermal resistance junction-case	0.6		$^\circ\text{C}/\text{W}$
$R_{thj\text{-amb}}$	Thermal resistance junction-ambient	62.5	50	$^\circ\text{C}/\text{W}$

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not repetitive (pulse width limited by $T_{j\text{max}}$ )	5	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	750	mJ

## 2 Electrical characteristics

$T_C = 25\text{ }^\circ\text{C}$  unless otherwise specified

Table 5: On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$	600			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$ , $V_{DS} = 600\text{ V}$			1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$ , $V_{DS} = 600\text{ V}$ , $T_C = 125\text{ }^\circ\text{C}^{(1)}$			100	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 25\text{ V}$			$\pm 5$	$\mu\text{A}$
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	3.25	4	4.75	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$ , $I_D = 15\text{ A}$		85	99	$\text{m}\Omega$

**Notes:**

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

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	1960	-	$\text{pF}$
$C_{oss}$	Output capacitance		-	93	-	$\text{pF}$
$C_{riss}$	Reverse transfer capacitance		-	6	-	$\text{pF}$
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }480\text{ V}$ , $V_{GS} = 0\text{ V}$	-	332	-	$\text{pF}$
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz}$ , $I_D = 0\text{ A}$	-	1.6	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 480\text{ V}$ , $I_D = 30\text{ A}$ , $V_{GS} = 0\text{ to }10\text{ V}$ (see <a href="#">Figure 17: "Test circuit for gate charge behavior"</a> )	-	44.3	-	$\text{nC}$
$Q_{gs}$	Gate-source charge		-	10.1	-	$\text{nC}$
$Q_{gd}$	Gate-drain charge		-	25	-	$\text{nC}$

**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 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$ , $I_D = 15\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see <i>Figure 18: "Test circuit for inductive load switching and diode recovery times"</i> and <i>Figure 21: "Switching time waveform"</i> )	-	15.2	-	ns
$t_r$	Rise time		-	5.3	-	ns
$t_{d(off)}$	Turn-off-delay time		-	50.2	-	ns
$t_f$	Fall time		-	7.3	-	ns

Table 8: Source drain diode

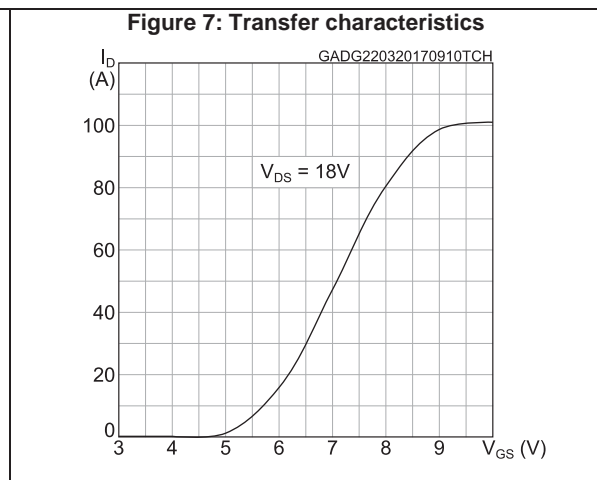
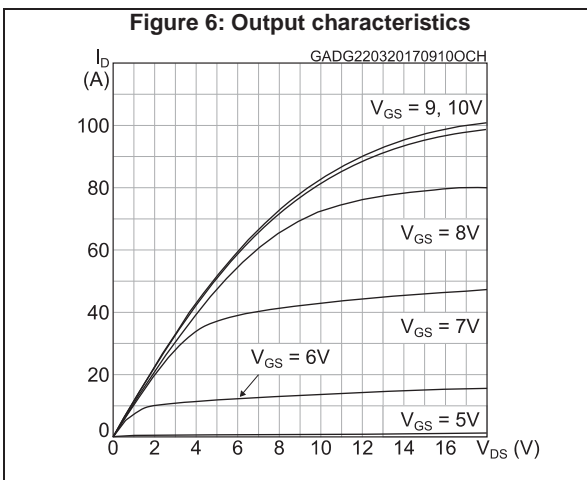
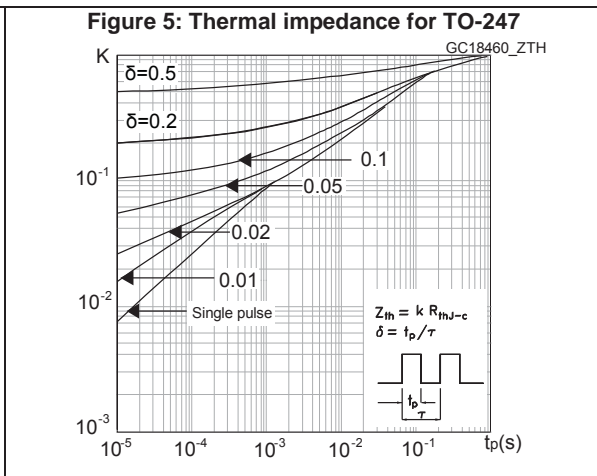
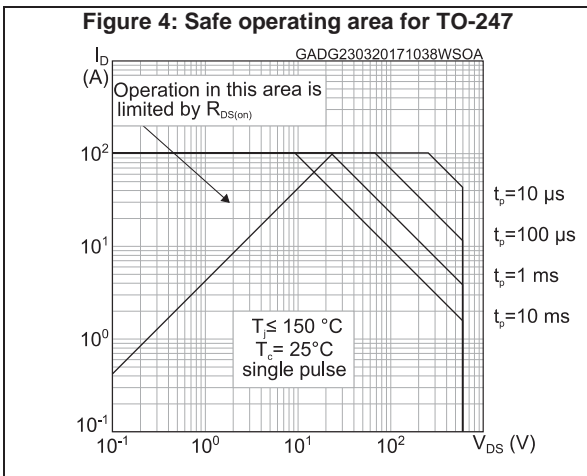
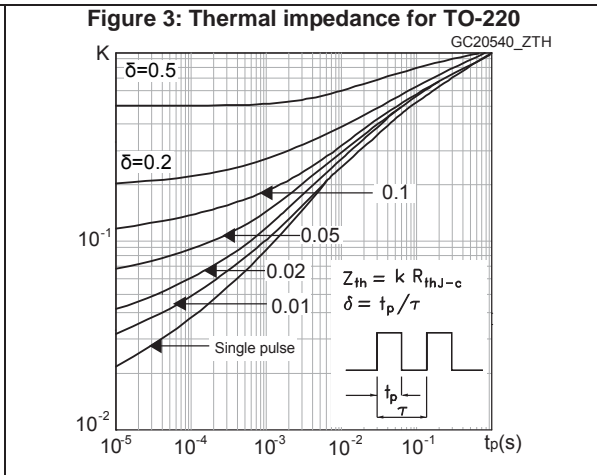
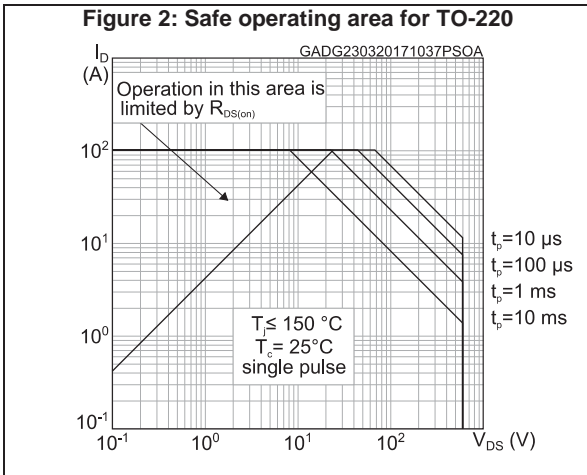
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		30	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		102	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$ , $I_{SD} = 30\text{ A}$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 30\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 60\text{ V}$ (see <i>Figure 18: "Test circuit for inductive load switching and diode recovery times"</i> )	-	340		ns
$Q_{rr}$	Reverse recovery charge		-	5.3		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	31		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 30\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 60\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ (see <i>Figure 18: "Test circuit for inductive load switching and diode recovery times"</i> )	-	430		ns
$Q_{rr}$	Reverse recovery charge		-	7.7		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	36		A

**Notes:**

(1)Pulse width is limited by safe operating area.

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

## 2.1 Electrical characteristics (curves)



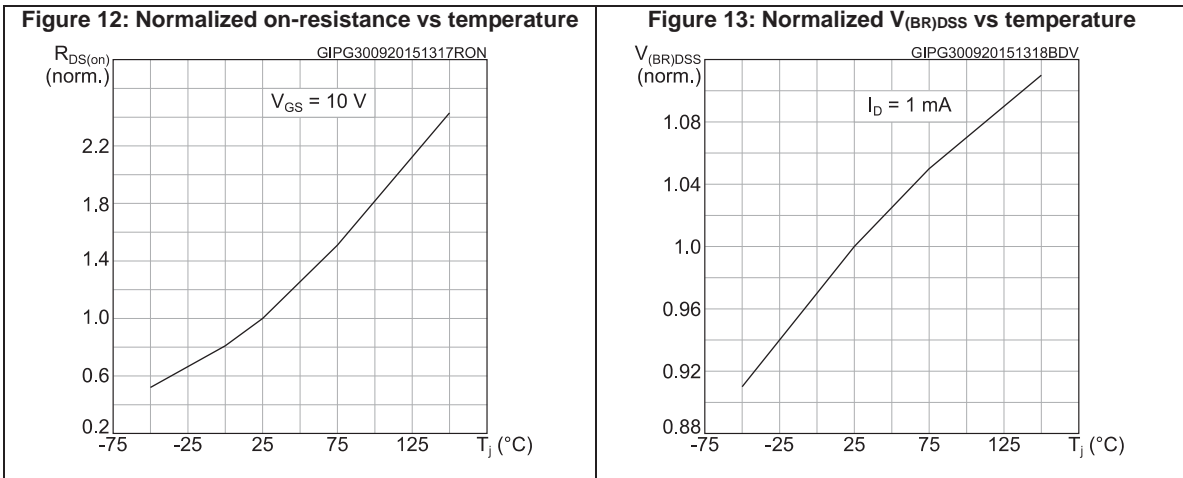
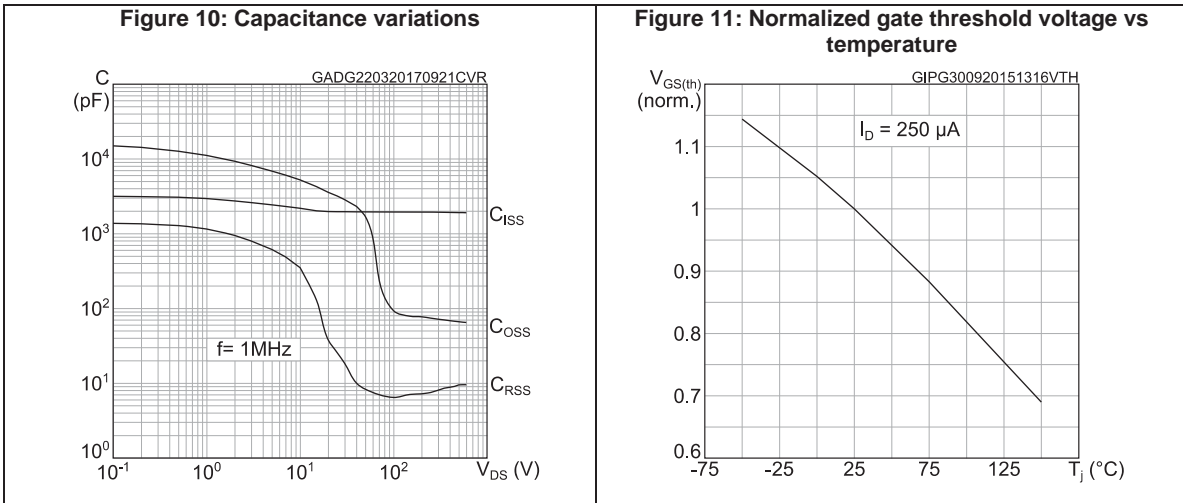
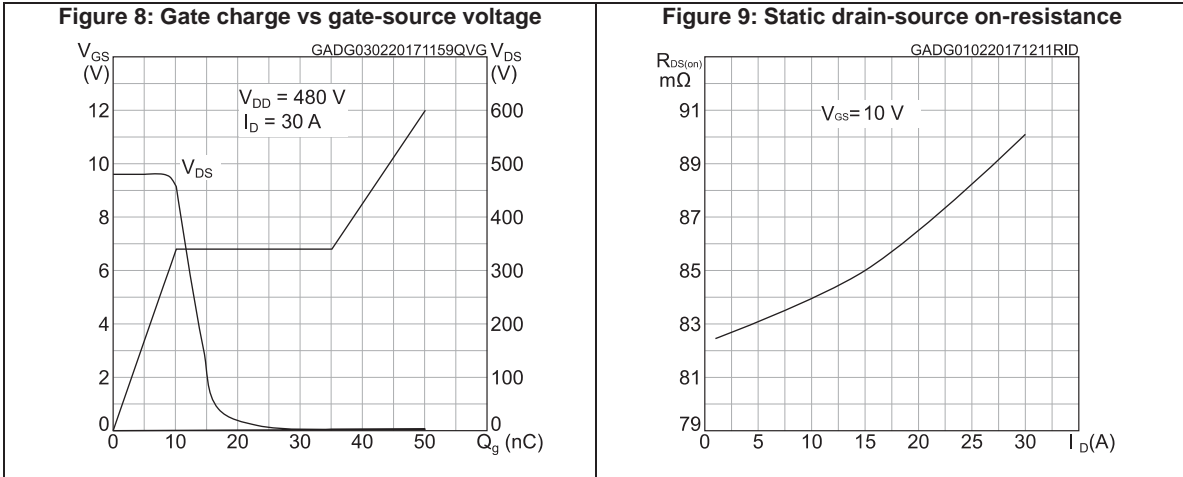


Figure 14: Output capacitance stored energy

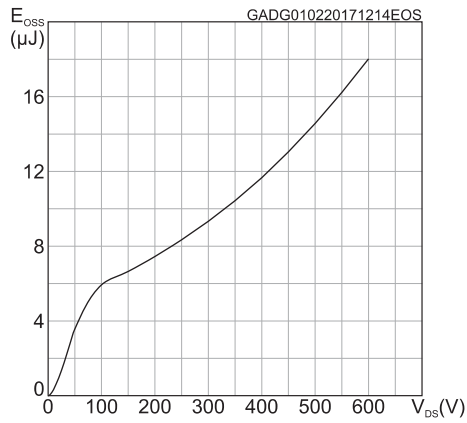
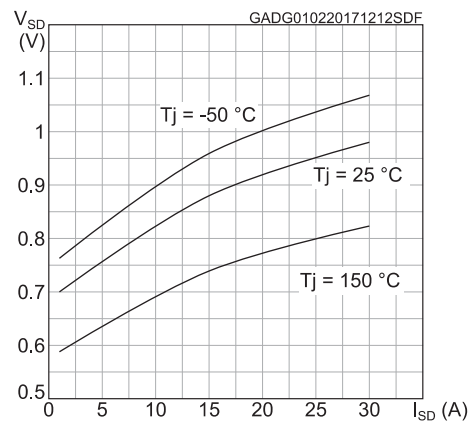
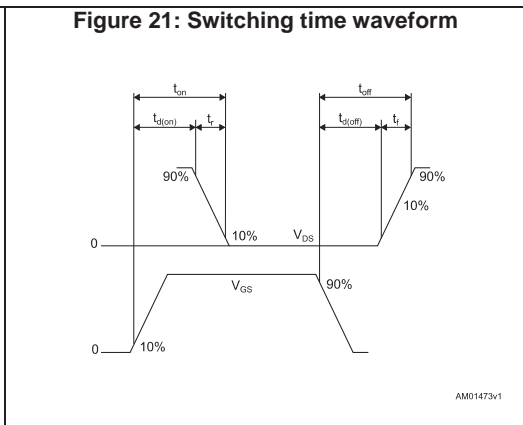
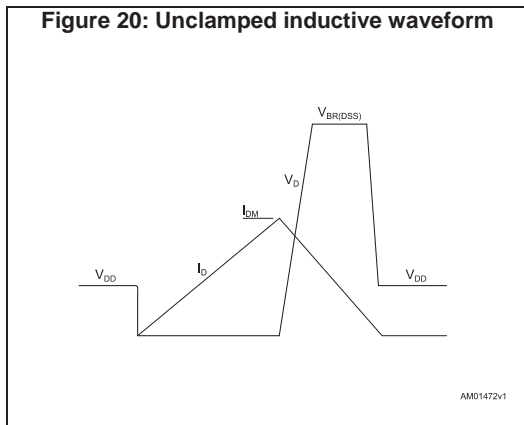
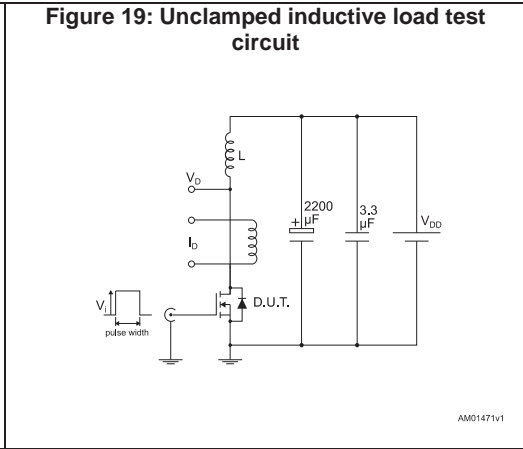
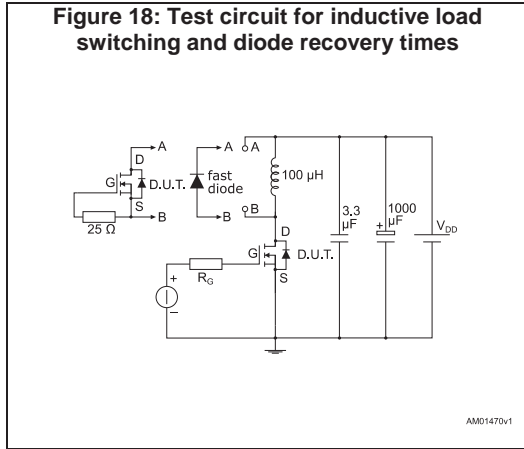
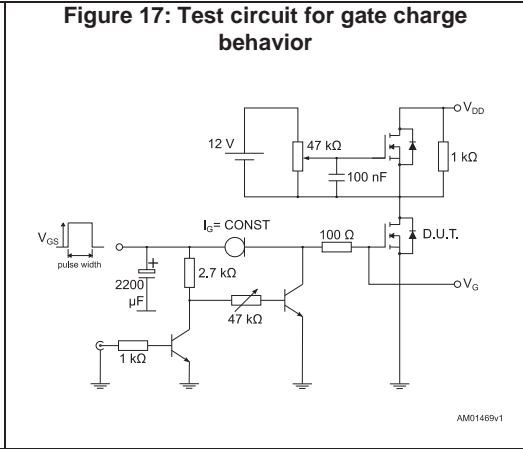
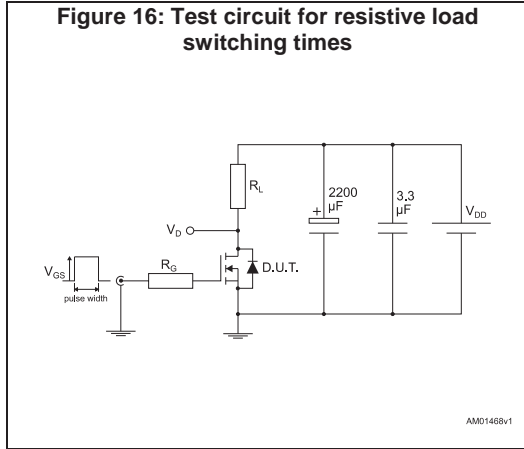


Figure 15: Source-drain diode forward characteristics





### 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 TO-220 type A package information

Figure 22: TO-220 type A package outline

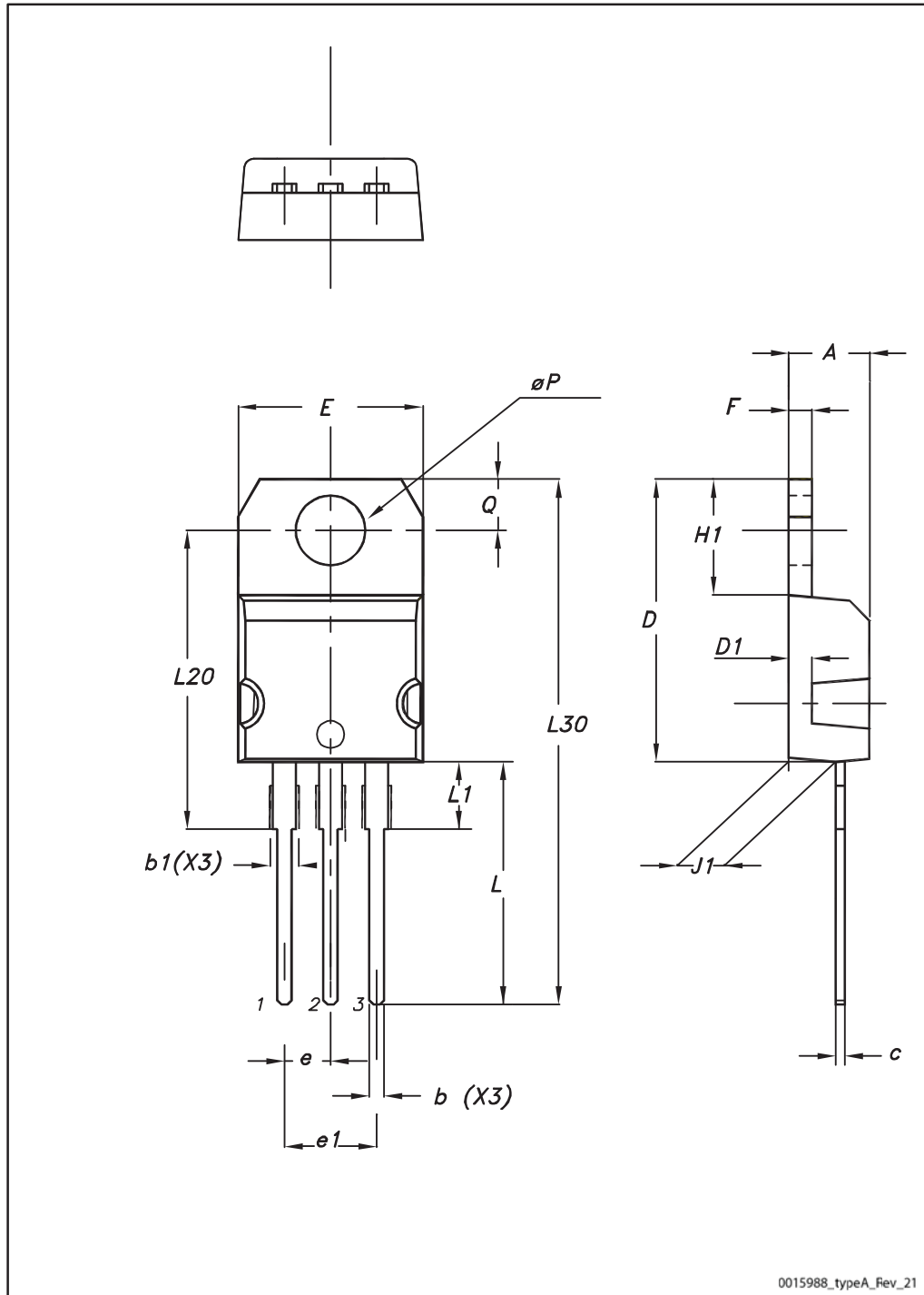


Table 9: TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		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	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95

4.2 TO-247 package information

Figure 23: TO-247 package outline

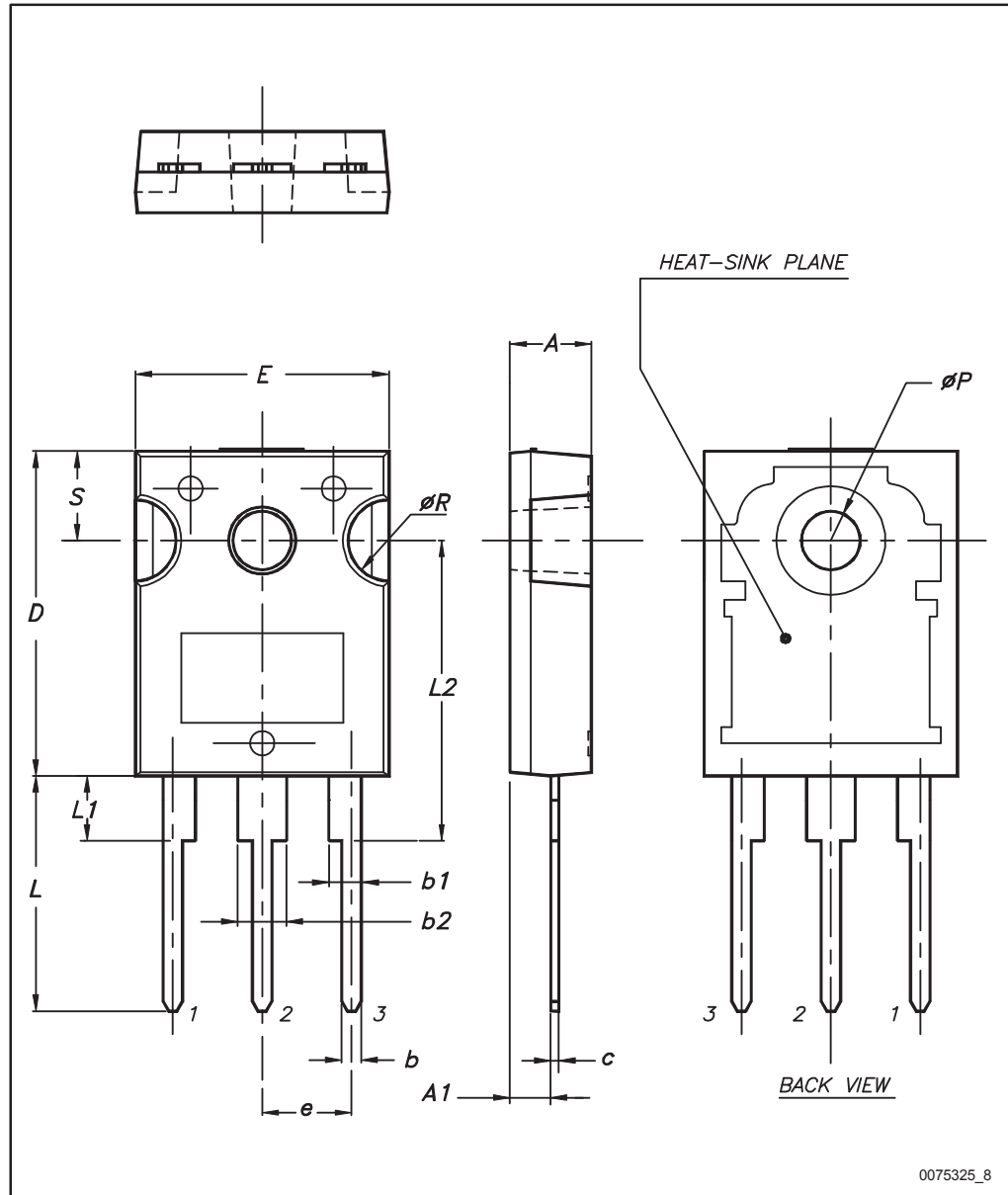


Table 10: TO-247 package mechanical data

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

## 5 Revision history

Table 11: Document revision history

Date	Revision	Changes
06-Oct-2015	1	First release
14-Oct-2015	2	Updated: $V_{DD}$ value in <i>Table 8: "Source drain diode"</i> Minor text changes
27-Mar-2017	3	Updated <i>Table 2: "Absolute maximum ratings"</i> . Updated <i>Section 2: "Electrical characteristics"</i> . Updated <i>Section 4: "Package information"</i> . Minor text changes

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