

## N-channel 600 V, 0.14 $\Omega$ typ., 20 A MDmesh™ M2 Power MOSFETs in TO-220 and TO-247 packages

Datasheet - production data

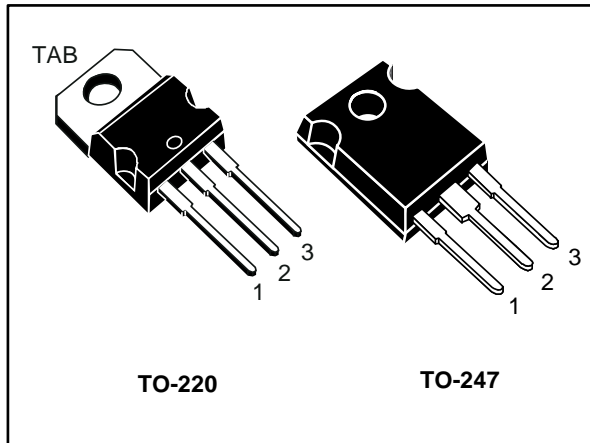
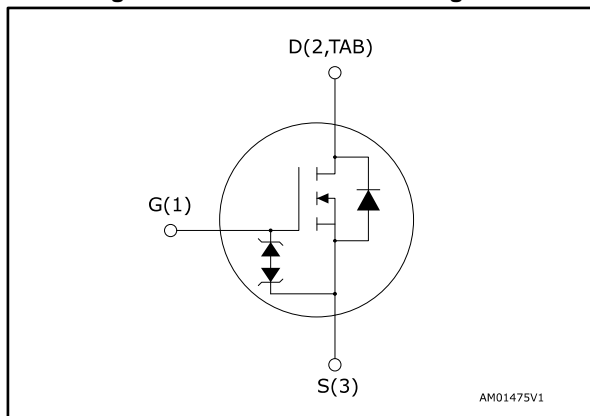


Figure 1: Internal schematic diagram



### Features

Order code	$V_{DS}$ @ $T_{Jmax}$	$R_{DS(on)}$ max.	$I_D$	$P_{TOT}$
STP26N60M2	650 V	0.165 $\Omega$	20 A	169 W
STW26N60M2				

- Extremely low gate charge
- Excellent output capacitance ( $C_{oss}$ ) profile
- 100% avalanche tested
- Zener-protected

### Applications

- Switching applications

### Description

These devices are N-channel Power MOSFETs developed using MDmesh™ M2 technology. Thanks to their strip layout and improved vertical structure, these devices exhibit low on-resistance and optimized switching characteristics, rendering them suitable for the most demanding high efficiency converters.

Table 1: Device summary

Order code	Marking	Package	Packing
STP26N60M2	26N60M2	TO-220	Tube
STW26N60M2		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 $T_{case} = 25\text{ }^\circ\text{C}$	20	A
	Drain current (continuous) at $T_{case} = 100\text{ }^\circ\text{C}$	13	
$I_{DM}^{(1)}$	Drain current (pulsed)	80	A
$P_{TOT}$	Total dissipation at $T_{case} = 25\text{ }^\circ\text{C}$	169	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
$dv/dt^{(3)}$	MOSFET $dv/dt$ ruggedness	50	
$T_{stg}$	Storage temperature range	-55 to 150	$^\circ\text{C}$
$T_j$	Operating junction temperature range		

**Notes:**

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

(2)  $I_{SD} \leq 20\text{ A}$ ,  $di/dt=400\text{ A}/\mu\text{s}$ ;  $V_{DS(peak)} < V_{(BR)DSS}$ ,  $V_{DD} = 80\% V_{(BR)DSS}$ .

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

**Table 3: Thermal data**

Symbol	Parameter	Value		Unit
		TO-220	TO-247	
$R_{thj-case}$	Thermal resistance junction-case	0.74		$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient	62.5	50	

**Table 4: Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}^{(1)}$	Avalanche current, repetitive or not repetitive	3.8	A
$E_{AS}^{(2)}$	Single pulse avalanche energy	250	mJ

**Notes:**

(1) Pulse width limited by  $T_{jmax}$ .

(2) starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = I_{AR}$ ,  $V_{DD} = 50\text{ V}$ .

## 2 Electrical characteristics

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

**Table 5: Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$ , $I_{\text{D}} = 1\text{ mA}$	600			V
$I_{\text{DSS}}$	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 600\text{ V}$			1	$\mu\text{A}$
		$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 600\text{ V}$ , $T_{\text{case}} = 125\text{ °C}^{(1)}$			100	
$I_{\text{GSS}}$	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$ , $V_{\text{GS}} = \pm 25\text{ V}$			$\pm 10$	$\mu\text{A}$
$V_{\text{GS(th)}}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$ , $I_{\text{D}} = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$ , $I_{\text{D}} = 10\text{ A}$		0.14	0.165	$\Omega$

**Notes:**

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

**Table 6: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{\text{iss}}$	Input capacitance	$V_{\text{DS}} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{\text{GS}} = 0\text{ V}$	-	1360	-	$\text{pF}$
$C_{\text{oss}}$	Output capacitance		-	88	-	
$C_{\text{rss}}$	Reverse transfer capacitance		-	2	-	
$C_{\text{oss eq.}}^{(1)}$	Equivalent output capacitance	$V_{\text{DS}} = 0\text{ to }480\text{ V}$ , $V_{\text{GS}} = 0\text{ V}$	-	124	-	$\text{pF}$
$R_{\text{G}}$	Intrinsic gate resistance	$f = 1\text{ MHz}$ , $I_{\text{D}} = 0\text{ A}$	-	4	-	$\Omega$
$Q_{\text{g}}$	Total gate charge	$V_{\text{DD}} = 480\text{ V}$ , $I_{\text{D}} = 20\text{ A}$ , $V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 17: "Test circuit for gate charge behavior"</a> )	-	34	-	$\text{nC}$
$Q_{\text{gs}}$	Gate-source charge		-	5.6	-	
$Q_{\text{gd}}$	Gate-drain charge		-	16.3	-	

**Notes:**

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

**Table 7: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d(on)}}$	Turn-on delay time	$V_{\text{DD}} = 300\text{ V}$ , $I_{\text{D}} = 10\text{ A}$ , $R_{\text{G}} = 4.7\text{ }\Omega$ , $V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 16: "Test circuit for resistive load switching times"</a> and <a href="#">Figure 21: "Switching time waveform"</a> )	-	20.2	-	$\text{ns}$
$t_{\text{r}}$	Rise time		-	8	-	
$t_{\text{d(off)}}$	Turn-off delay time		-	66	-	
$t_{\text{f}}$	Fall time		-	10	-	

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		20	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		80	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$ , $I_{SD} = 20\text{ A}$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 20\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 60\text{ V}$ (see <a href="#">Figure 18</a> : "Test circuit for inductive load switching and diode recovery times")	-	360		ns
$Q_{rr}$	Reverse recovery charge		-	5		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	27		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 20\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 60\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ (see <a href="#">Figure 18</a> : "Test circuit for inductive load switching and diode recovery times")	-	556		ns
$Q_{rr}$	Reverse recovery charge		-	8		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	29		A

**Notes:**

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

## 2.1 Electrical characteristics (curves)

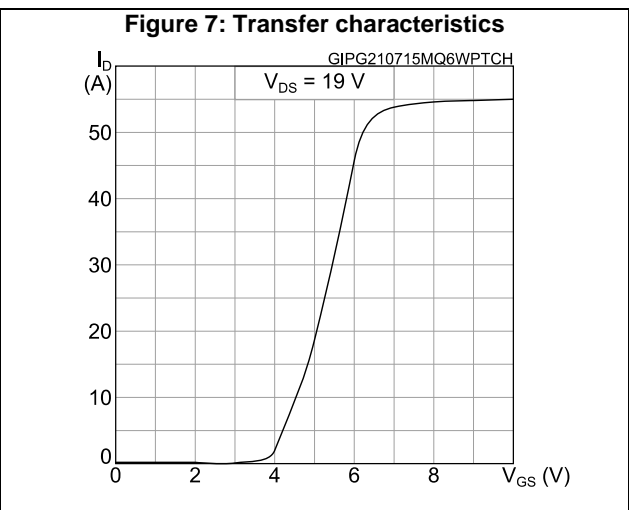
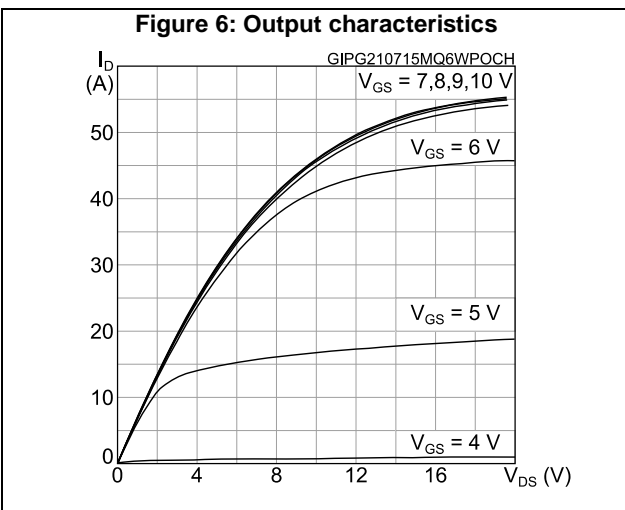
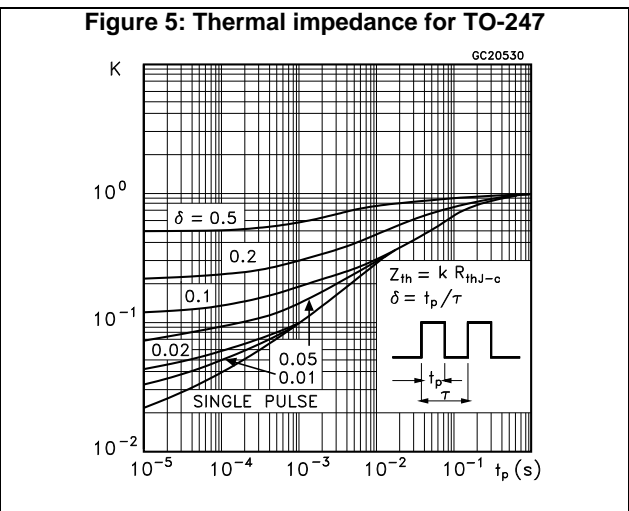
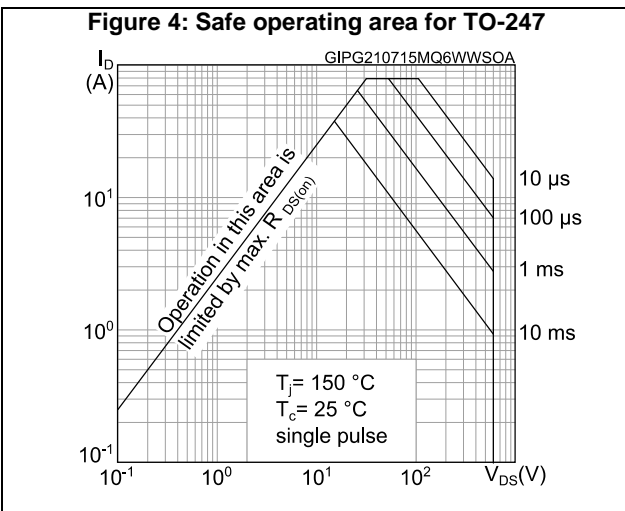
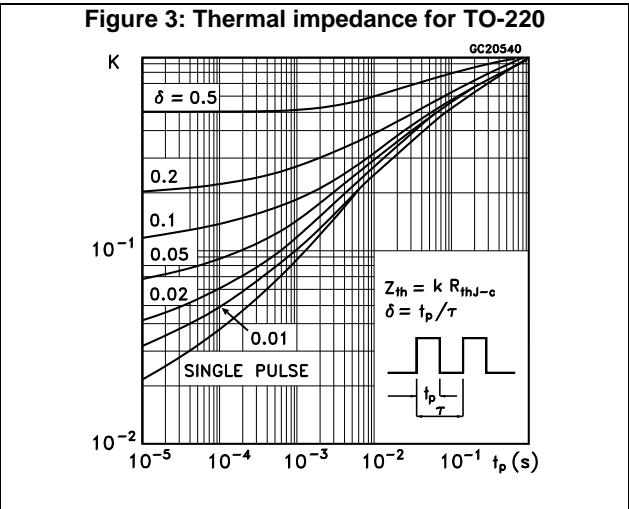
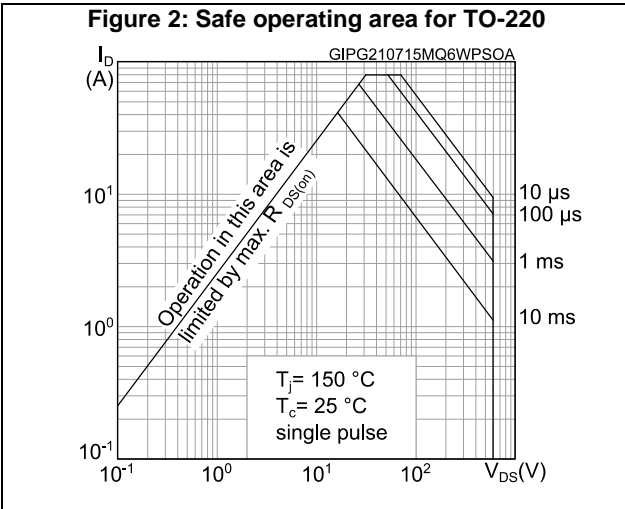


Figure 8: Gate charge vs gate-source voltage

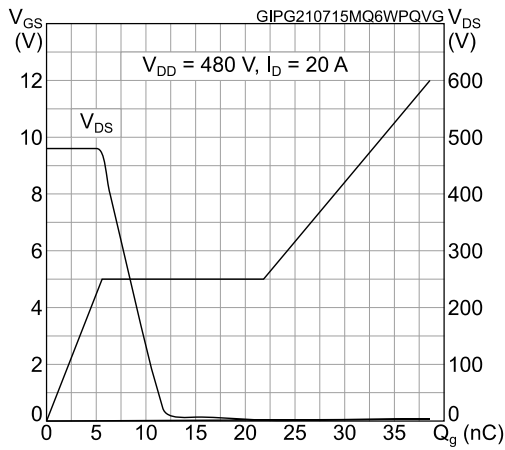


Figure 9: Static drain-source on-resistance

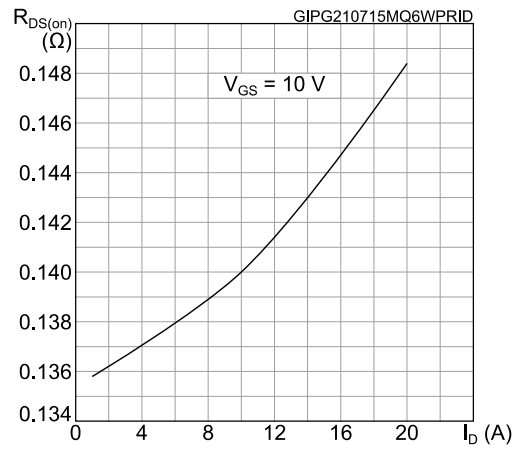


Figure 10: Capacitance variations

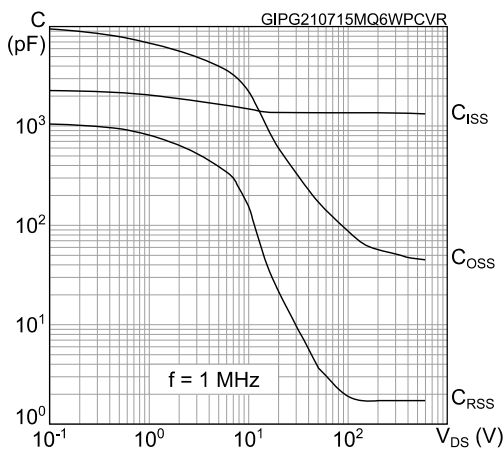


Figure 11: Normalized gate threshold voltage vs temperature

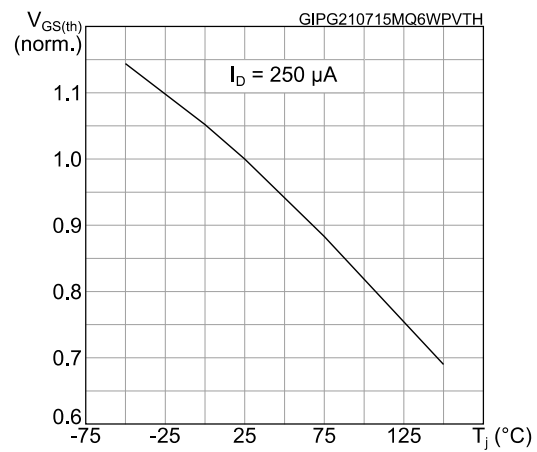


Figure 12: Normalized on-resistance vs temperature

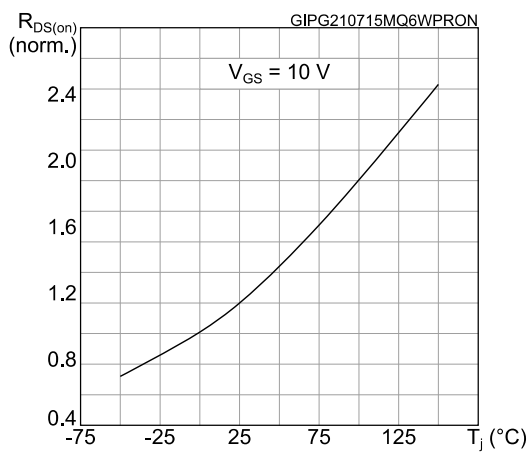


Figure 13: Normalized V(BR)DSS vs temperature

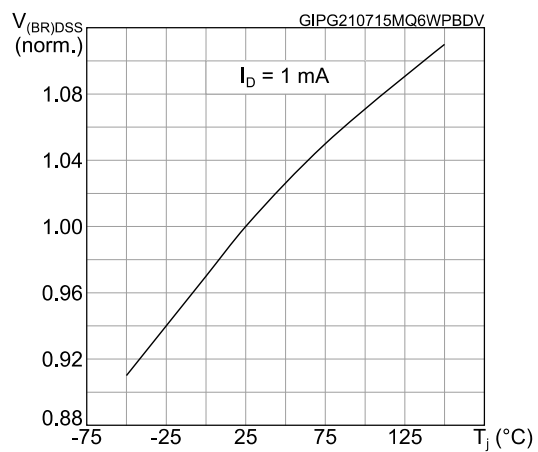


Figure 14: Output capacitance stored energy

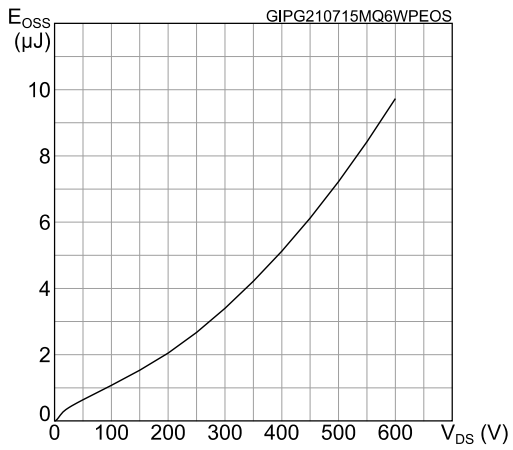
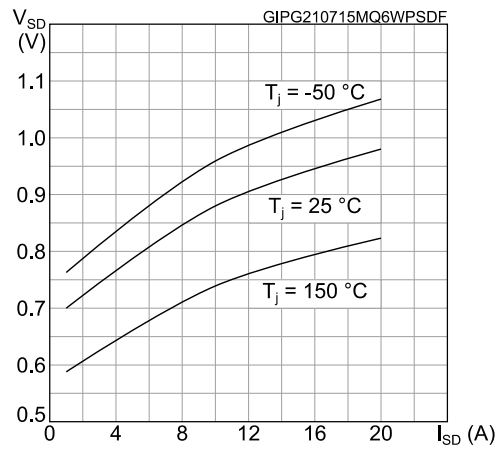


Figure 15: Source-drain diode forward characteristics





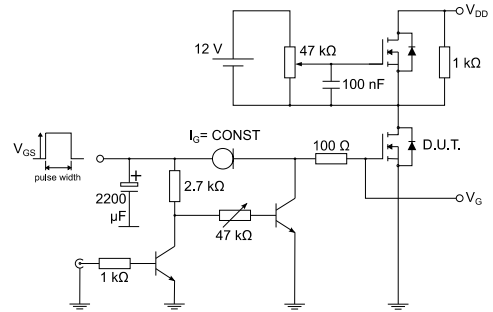
### 3 Test circuits

**Figure 16: Test circuit for resistive load switching times**



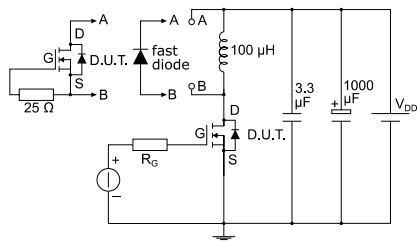
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**Figure 17: Test circuit for gate charge behavior**



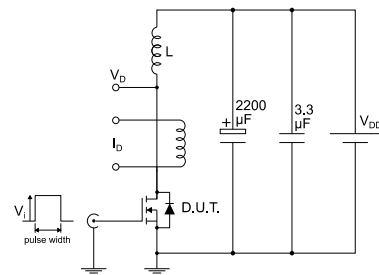
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**Figure 18: Test circuit for inductive load switching and diode recovery times**



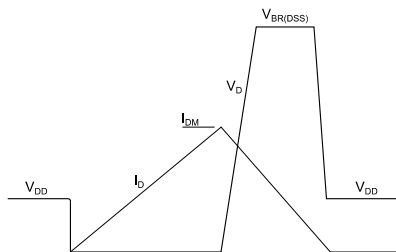
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**Figure 19: Unclamped inductive load test circuit**



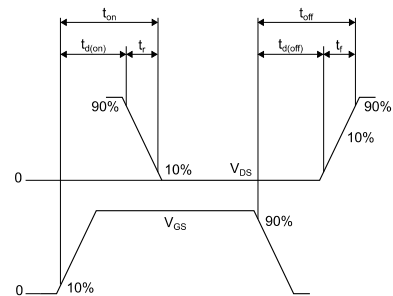
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**Figure 20: Unclamped inductive waveform**



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**Figure 21: Switching time waveform**



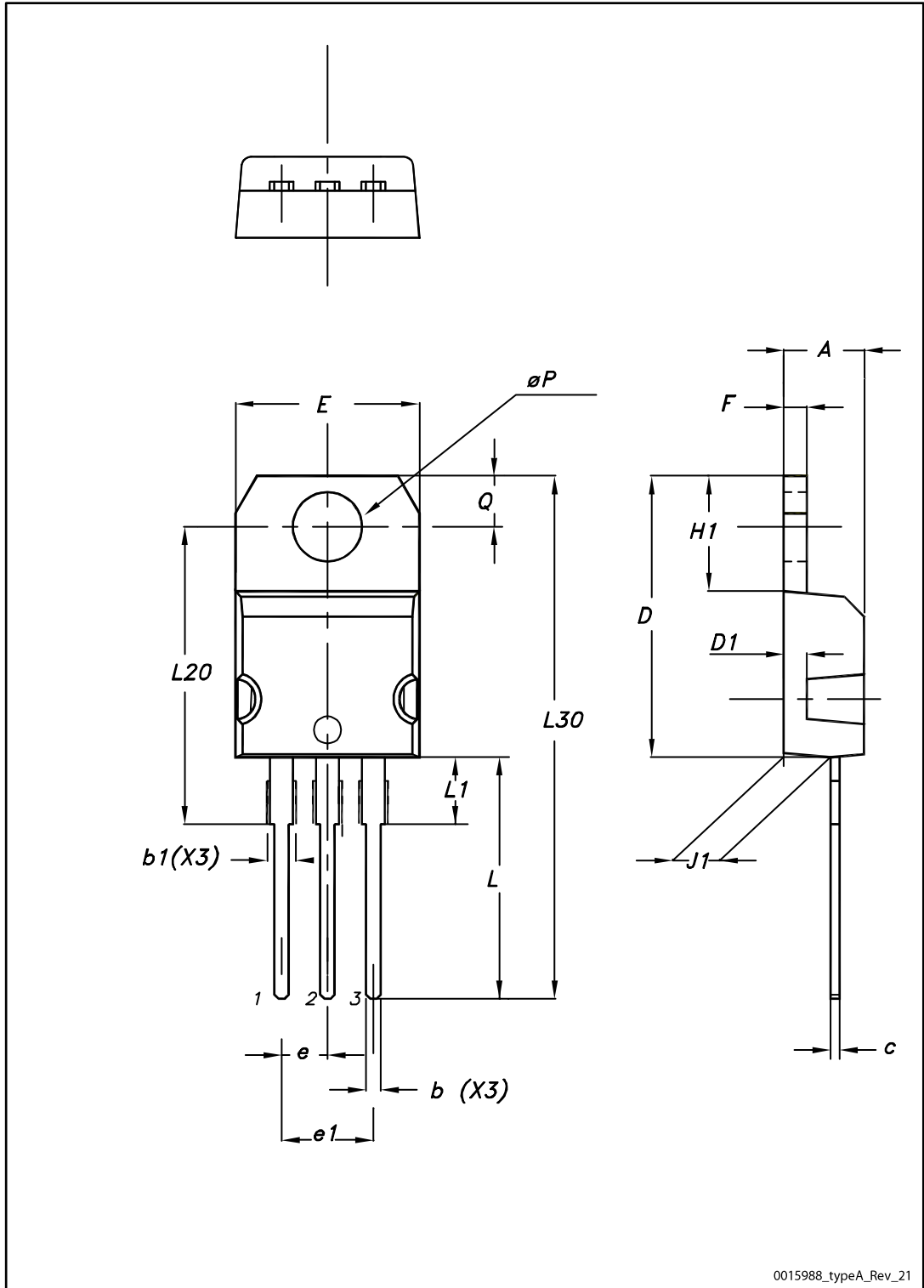
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## 4 Package information

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



0015988\_typeA\_Rev\_21

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

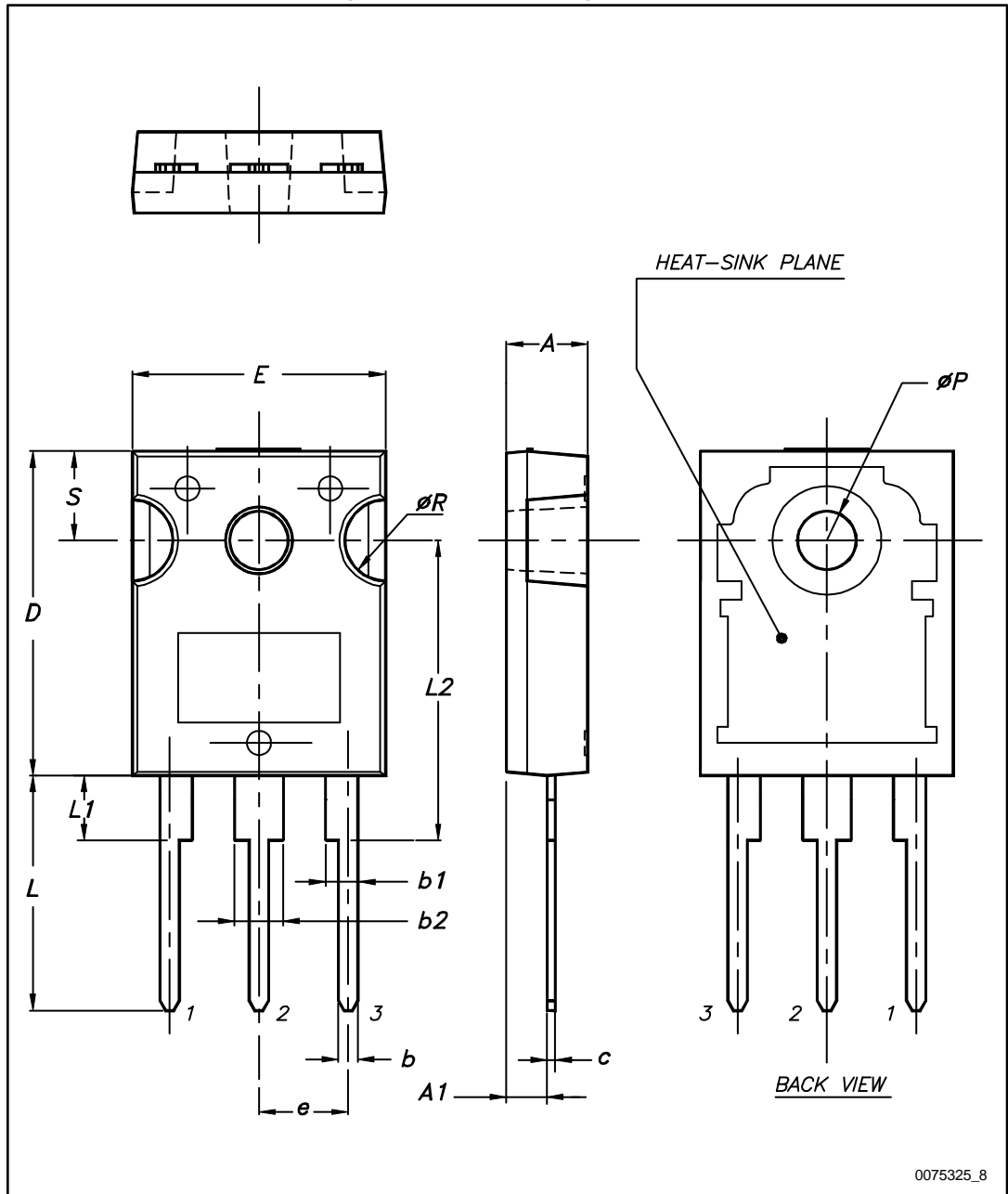


Table 10: TO-247 package mechanical data

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
03-Aug-2015	1	First release.
08-Mar-2017	2	Updated <i>Table 2: "Absolute maximum ratings"</i> , <i>Table 3: "Thermal data"</i> and <i>Figure 10: "Capacitance variations"</i> . Minor text changes.

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