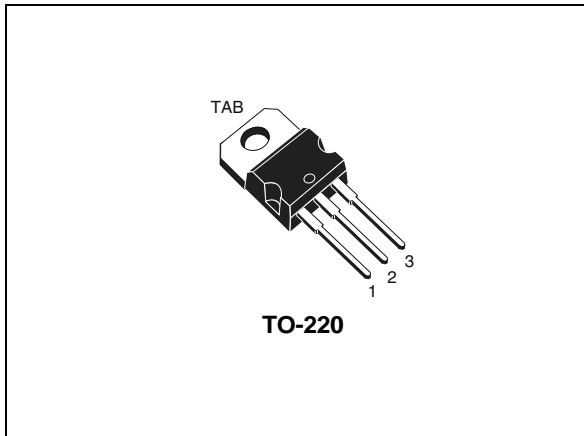


## N-channel 100 V, 2.3 mΩ typ., 180 A STripFET™ VII DeepGATE™ Power MOSFET in a TO-220 package

Datasheet - production data



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STP310N10F7	100 V	2.7 mΩ	180 A

- Ultra low on-resistance
- 100% avalanche tested

### Applications

- Switching applications

### Description

This device utilizes the 7<sup>th</sup> generation of design rules of ST's proprietary STripFET™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R<sub>DS(on)</sub> in all packages.

Figure 1. Internal schematic diagram

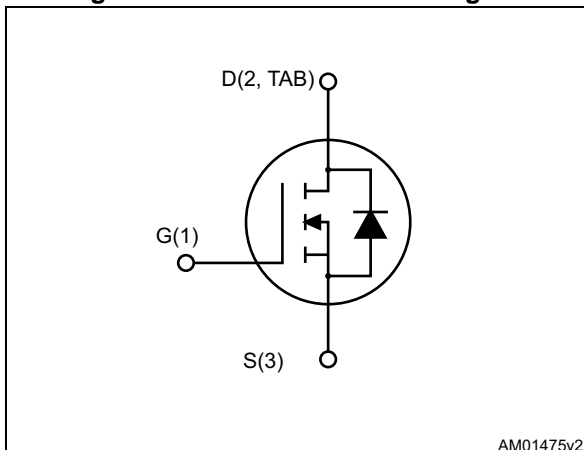


Table 1. Device summary

Order codes	Marking	Package	Packaging
STP310N10F7	310N10F7	TO-220	Tube

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	100	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	180	A
$I_D^{(1)}$	Drain current (continuous) at $T_C=100^\circ\text{C}$	120	A
$I_{DM}^{(2)}$	Drain current (pulsed)	720	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	315	W
	Derating factor	2.1	W/ $^\circ\text{C}$
$E_{AS}^{(3)}$	Single pulse avalanche energy ( $T_J = 25^\circ\text{C}$ , $L=0.55\text{ mH}$ , $I_{AS}=65\text{ A}$ )	1	J
$T_j$ $T_{stg}$	Operating junction temperature storage temperature	- 55 to 175	$^\circ\text{C}$

1. Current limited by package.
2. Pulse width limited by safe operating area.
3. Starting  $T_J=25^\circ\text{C}$ ,  $I_D=60\text{ A}$ ,  $V_{DD}=50\text{ V}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.48	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$

## 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 ( $V_{GS} = 0$ )	$I_D = 250\ \mu\text{A}$	100			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 100\ \text{V}$			1	$\mu\text{A}$
		$V_{DS} = 100\ \text{V}$ , $T_C = 125\text{°C}$			100	$\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = 20\ \text{V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	2.5	3.5	4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\ \text{V}$ , $I_D = 60\ \text{A}$		2.3	2.7	m $\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\ \text{V}$ , $f = 1\ \text{MHz}$ , $V_{GS} = 0$	-	12800	-	pF
$C_{oss}$	Output capacitance		-	3500	-	pF
$C_{rss}$	Reverse transfer capacitance		-	170	-	pF
$Q_g$	Total gate charge	$V_{DD} = 50\ \text{V}$ , $I_D = 180\ \text{A}$ , $V_{GS} = 10\ \text{V}$ (see <a href="#">Figure 14</a> )	-	180	-	nC
$Q_{gs}$	Gate-source charge		-	78	-	nC
$Q_{gd}$	Gate-source charge		-	34	-	nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 50\ \text{V}$ , $I_D = 90\ \text{A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\ \text{V}$ (see <a href="#">Figure 13</a> , <a href="#">Figure 18</a> )	-	62	-	ns
$t_r$	Rise time		-	108	-	ns
$t_{d(off)}$	Turn-off delay time		-	148	-	ns
$t_f$	Fall time		-	40	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		180	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		720	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=60\text{ A}$ , $V_{GS}=0$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD}=180\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD}=80\text{ V}$ , $T_j=150^\circ\text{C}$ (see <a href="#">Figure 15</a> )	-	85		ns
$Q_{rr}$	Reverse recovery charge		-	200		nC
$I_{RRM}$	Reverse recovery current		-	4.7		A

1. Pulse width limited by safe operating area.

2. Pulse duration = 300 $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

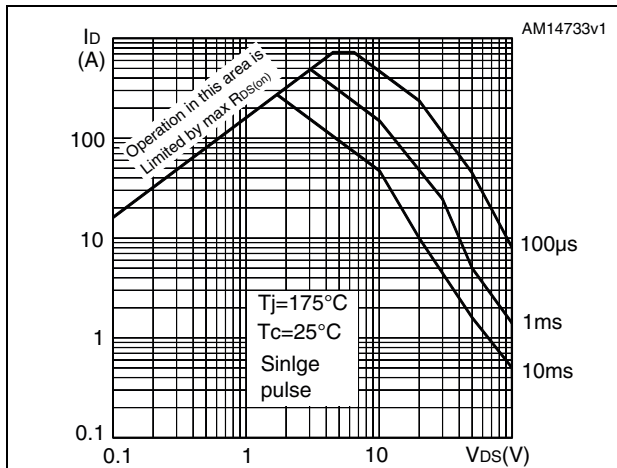


Figure 3. Thermal impedance

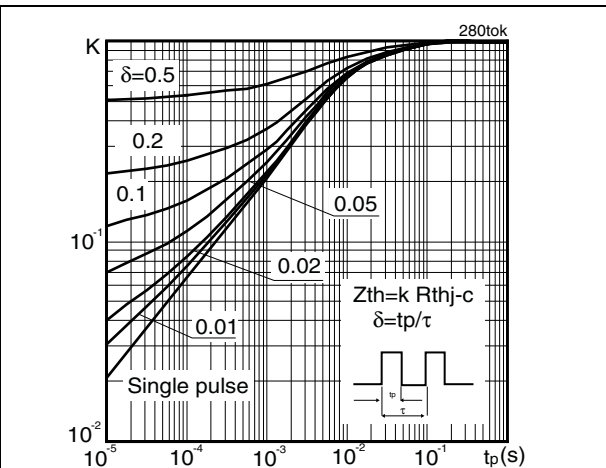


Figure 4. Output characteristics

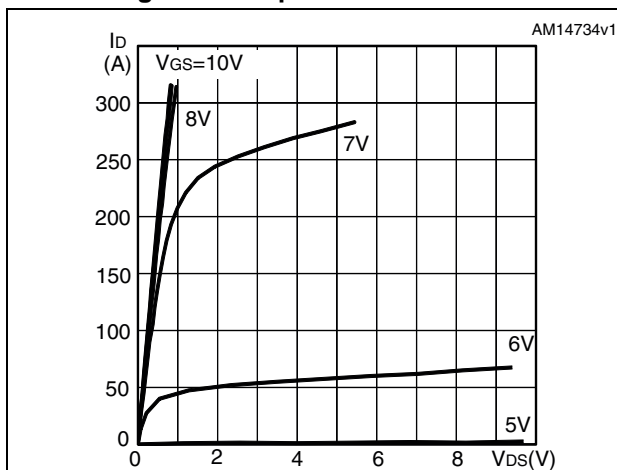


Figure 5. Transfer characteristics

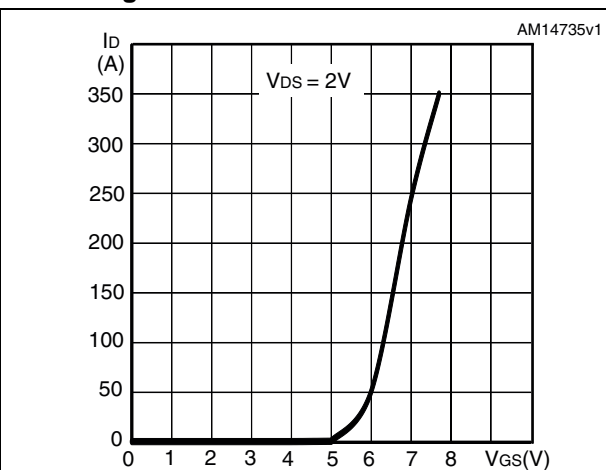


Figure 6. Gate charge vs gate-source voltage

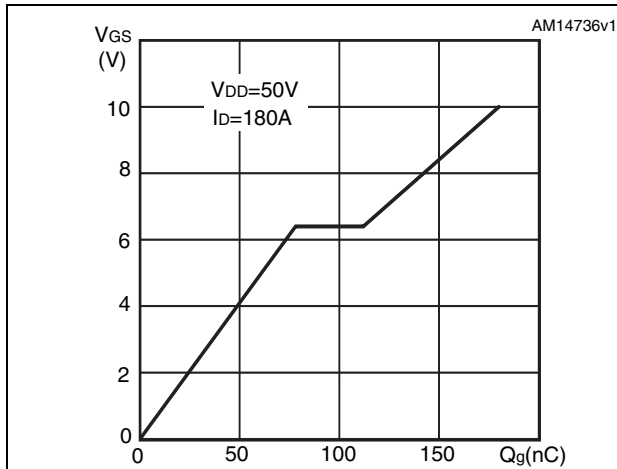


Figure 7. Static drain-source on-resistance

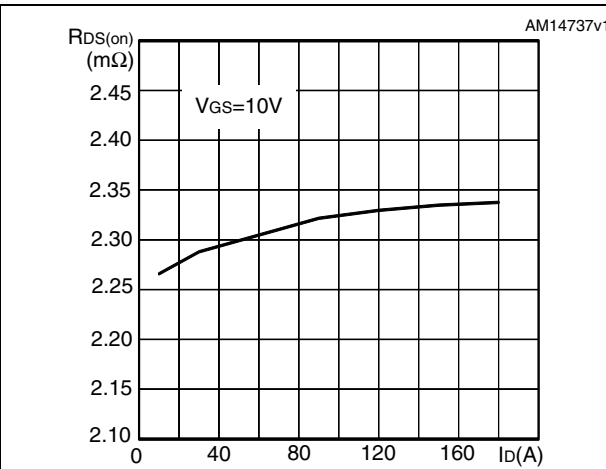


Figure 8. Capacitance variations

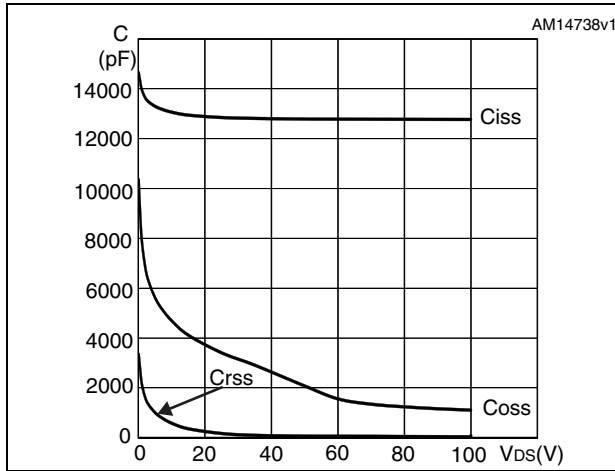


Figure 9. Source-drain diode forward characteristics

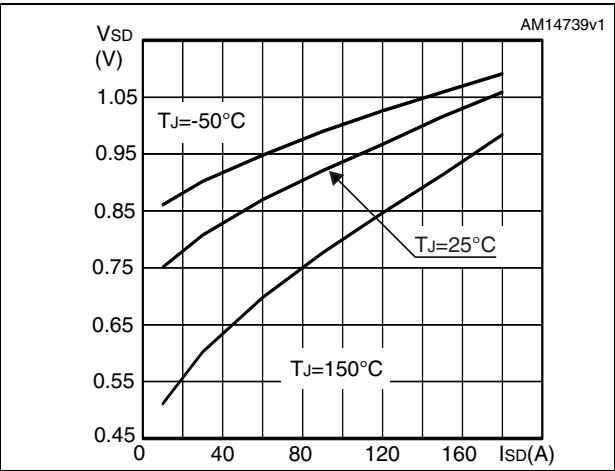


Figure 10. Normalized gate threshold voltage vs temperature

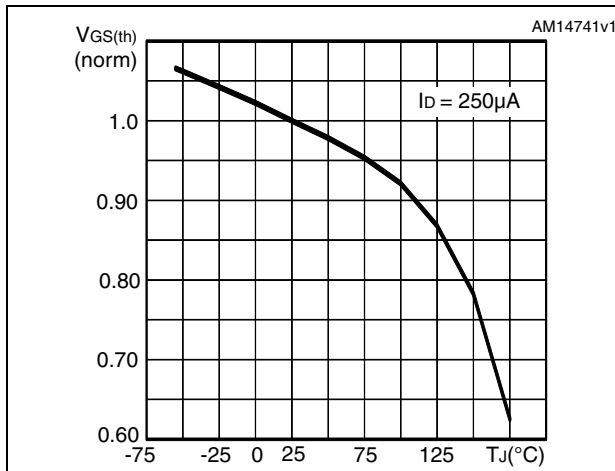


Figure 11. Normalized on-resistance vs temperature

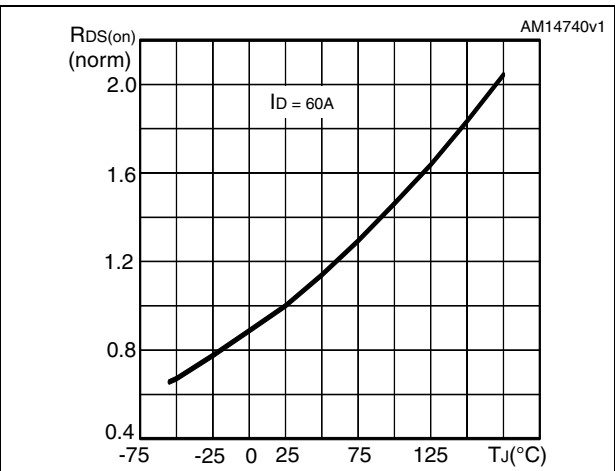
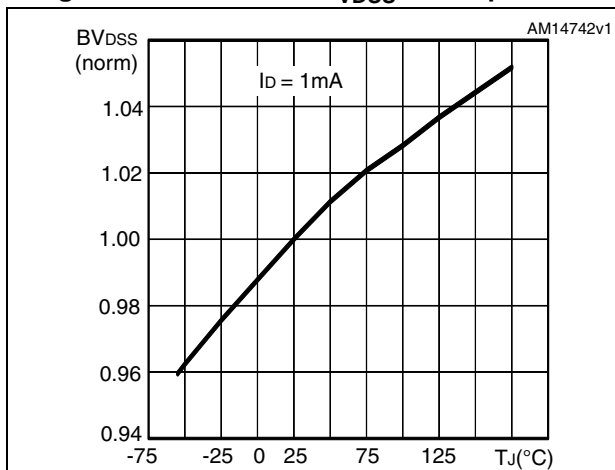


Figure 12. Normalized BV<sub>DSS</sub> vs temperature



### 3 Test circuits

Figure 13. Switching times test circuit for resistive load

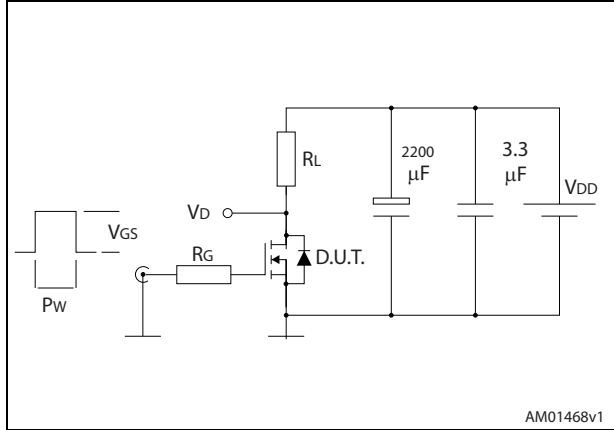


Figure 14. Gate charge test circuit

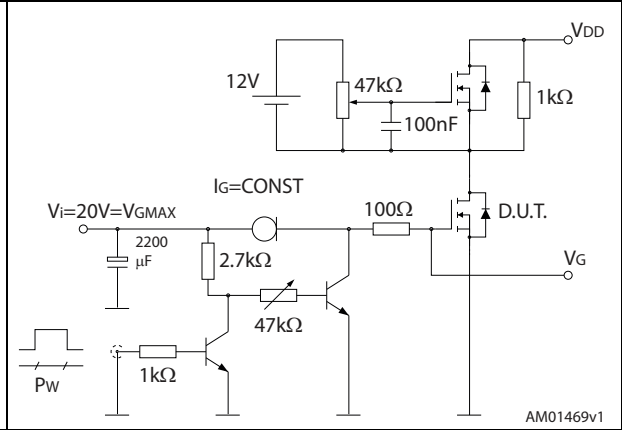


Figure 15. Test circuit for inductive load switching and diode recovery times

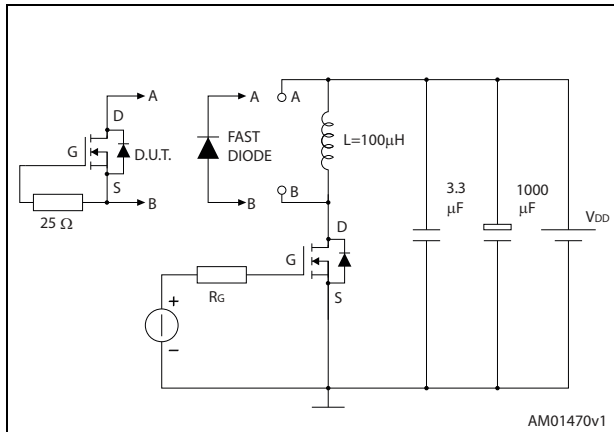


Figure 16. Unclamped inductive load test circuit

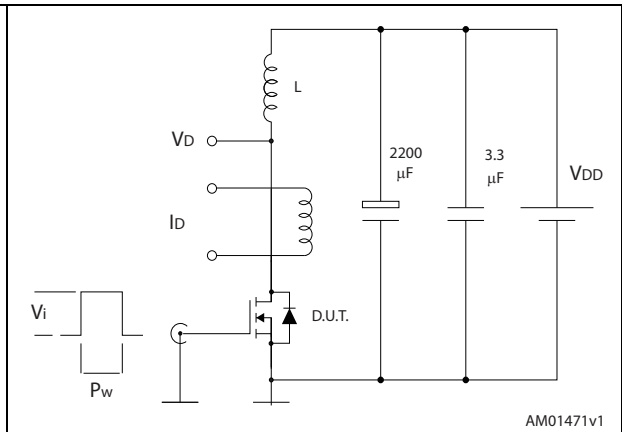


Figure 17. Unclamped inductive waveform

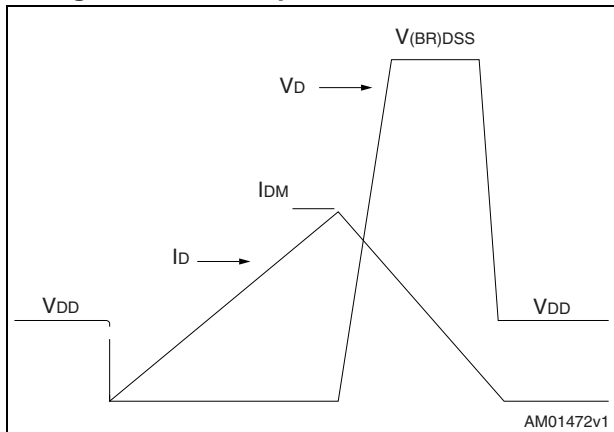
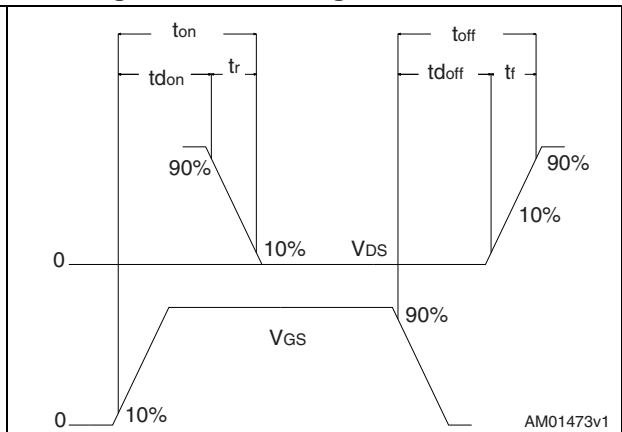


Figure 18. Switching time waveform





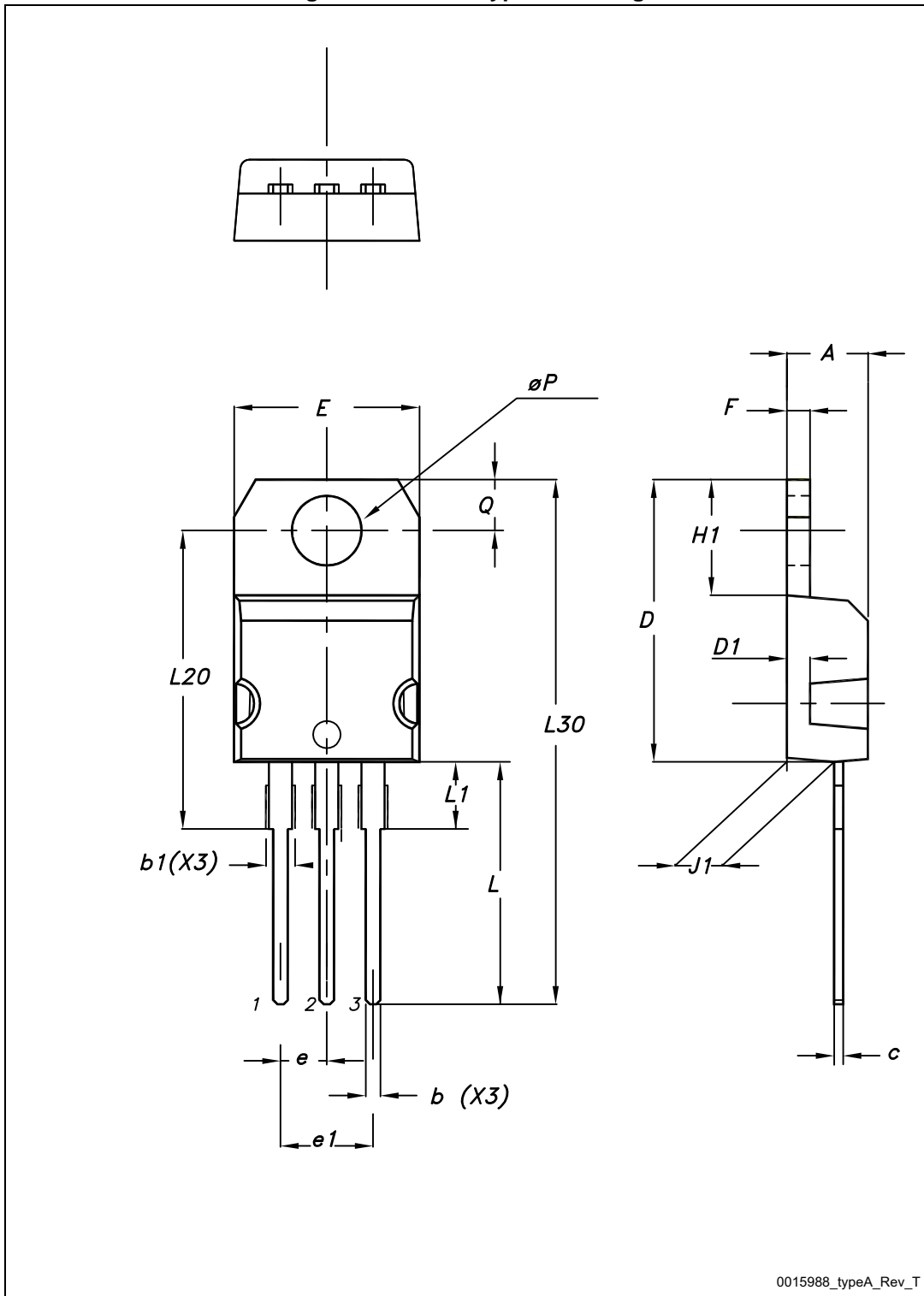
## 4 Package mechanical data

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-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		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		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

Figure 19. TO-220 type A drawing



## 5 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
19-Oct-2011	1	Initial version.
21-Dec-2011	2	Updated title and description in cover page.
06-Mar-2012	3	Updated $I_D$ value at $T_C = 25^\circ\text{C}$ in the whole document. <a href="#">Table 5</a> , <a href="#">Table 6</a> and <a href="#">Table 7</a> have been updated with typical values.
20-Aug-2012	4	Document status promoted from preliminary to production data. Added <a href="#">Section 2.1: Electrical characteristics (curves)</a> . Minor text changes.
31-Oct-2012	5	– Added: H <sup>2</sup> PAK-2 and H <sup>2</sup> PAK-6 packages – Updated: <a href="#">Section 4: Package mechanical data</a> and <a href="#">Section 4: Package mechanical data</a> – Minor text changes
07-Dec-2012	6	– Minor text changes – The part numbers STH310N10F7-2, STH310N10F7-6 have been moved to a separate datasheet
31-Jul-2013	7	– Modified: $I_{DSS}$ and $V_{GS(th)}$ values in <a href="#">Table 4</a> . – Minor text changes – Inserted: $E_{AS}$ value in <a href="#">Table 2</a>

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