

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

Datasheet - production data

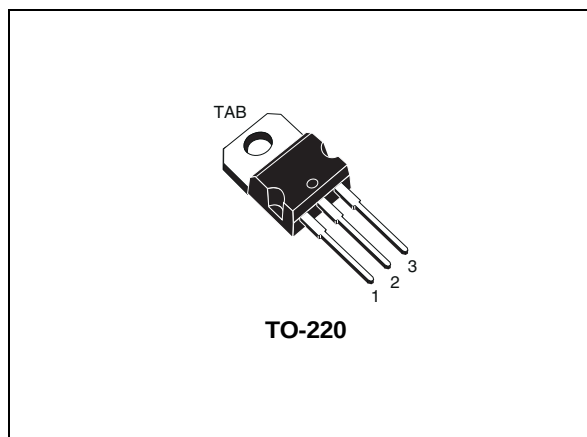
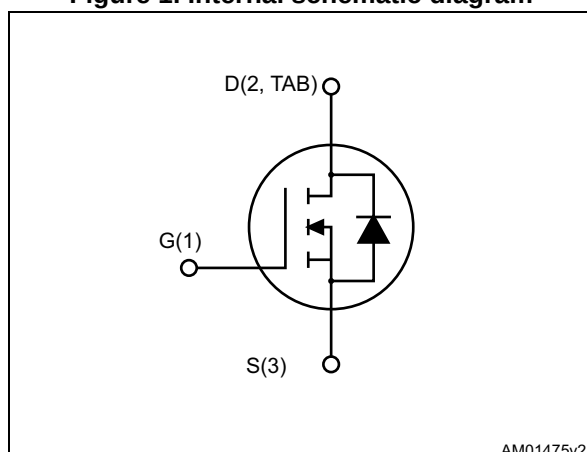


Figure 1. Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STP310N10F7	100 V	2.7 mΩ	180 A

- Ultra low on-resistance
- 100% avalanche tested

Applications

- Switching applications

Description

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

Table 1. Device summary

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

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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	± 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	$^\circ\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C/W}$

2 Electrical characteristics

($T_{CASE} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified).

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ($V_{GS} = 0$)	$I_D = 250\text{ }\mu\text{A}$	100			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 100\text{ V}$			1	μA
		$V_{DS} = 100\text{ V}$, $T_C = 125^{\circ}\text{C}$			100	μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = 20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	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	$\text{m}\Omega$

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 Figure 14)	-	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	$V_{DD} = 50\text{ V}$, $I_D = 90\text{ A}$ $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 13 , Figure 18)	-	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 Figure 15)	-	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 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

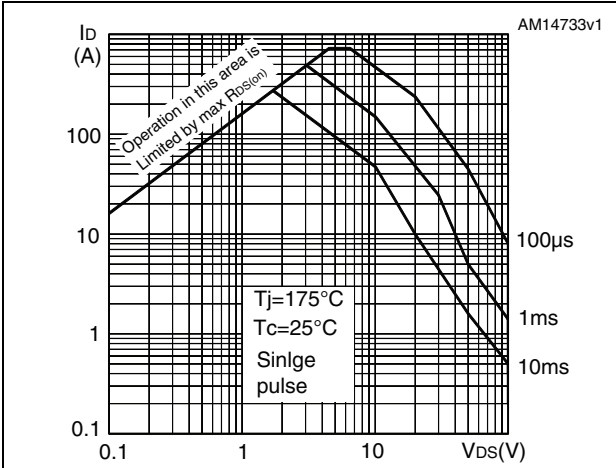


Figure 3. Thermal impedance

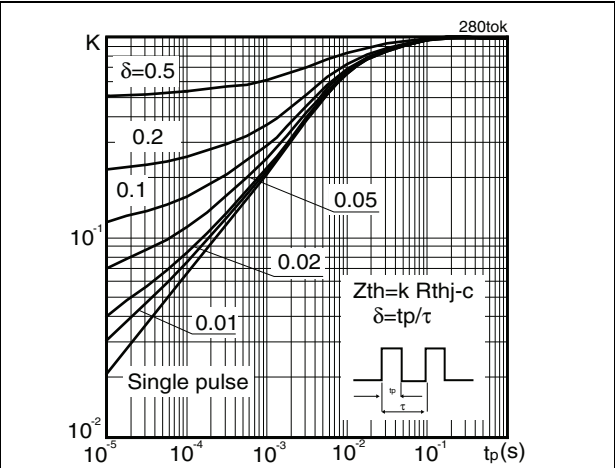


Figure 4. Output characteristics

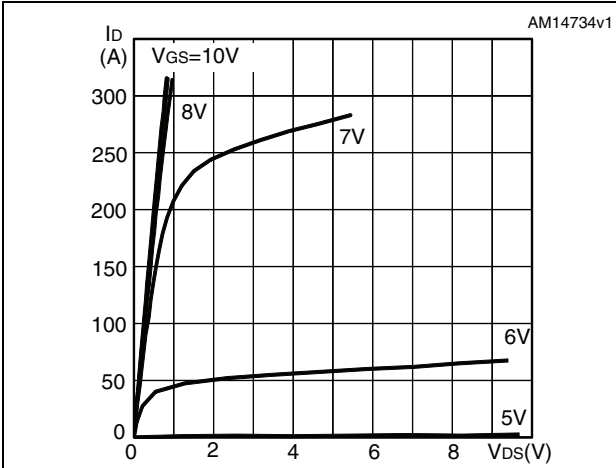


Figure 5. Transfer characteristics

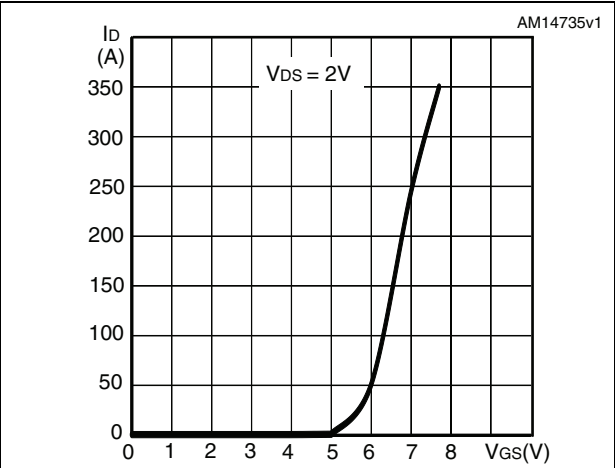


Figure 6. Gate charge vs gate-source voltage

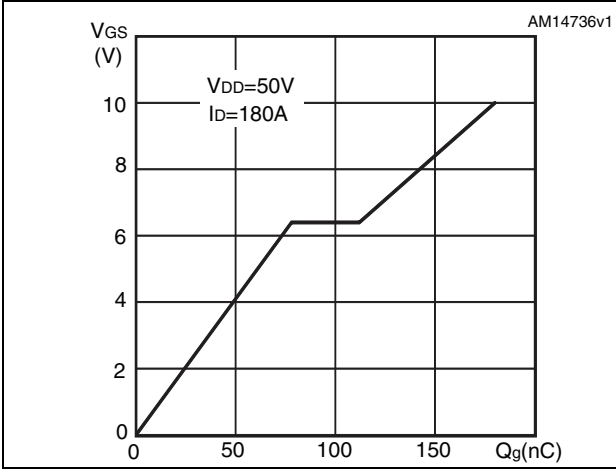


Figure 7. Static drain-source on-resistance

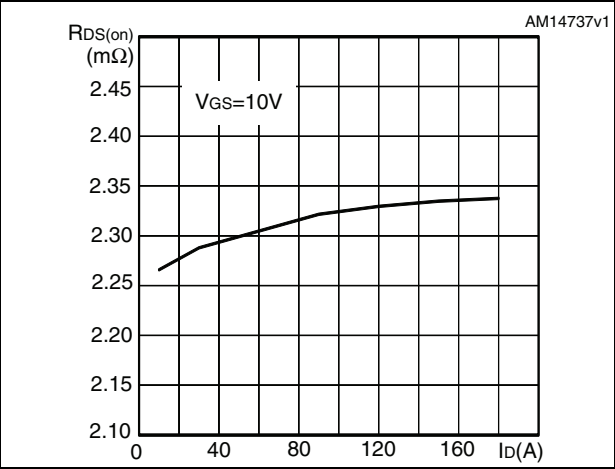


Figure 8. Capacitance variations

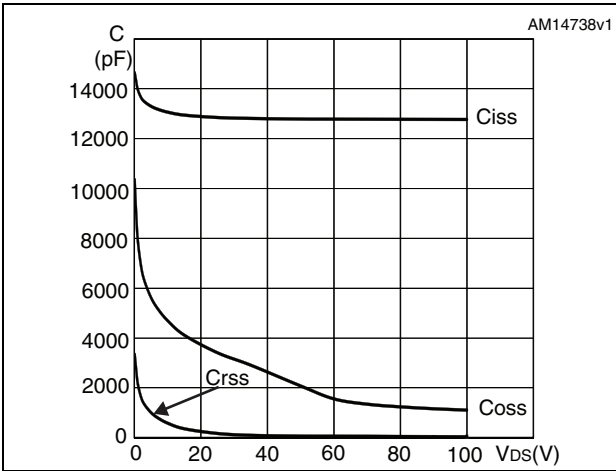


Figure 9. Source-drain diode forward characteristics

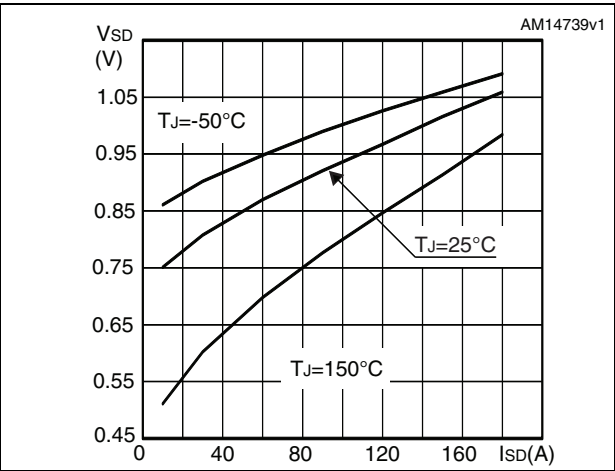


Figure 10. Normalized gate threshold voltage vs temperature

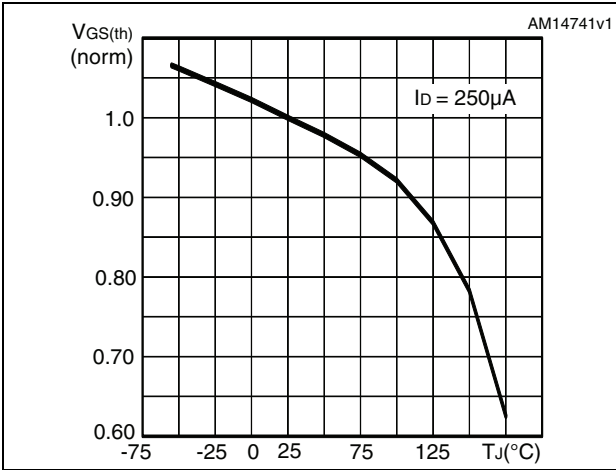


Figure 11. Normalized on-resistance vs temperature

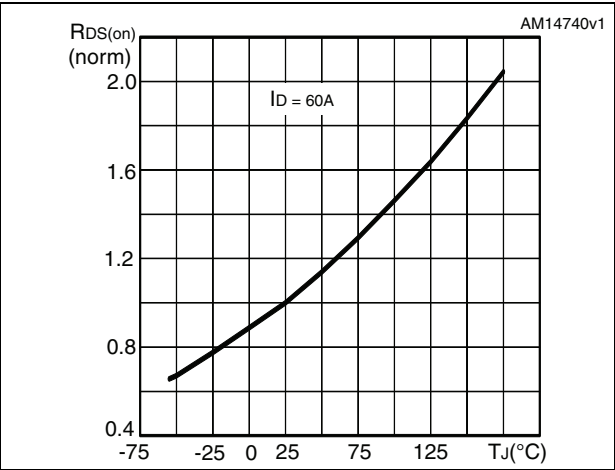
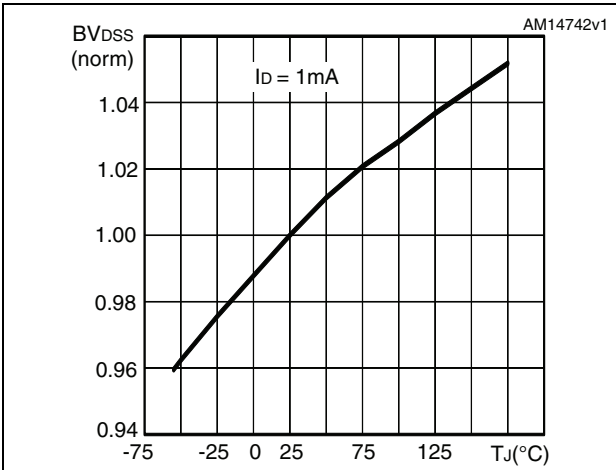


Figure 12. Normalized BVDS vs temperature



3 Test circuits

Figure 13. Switching times test circuit for resistive load

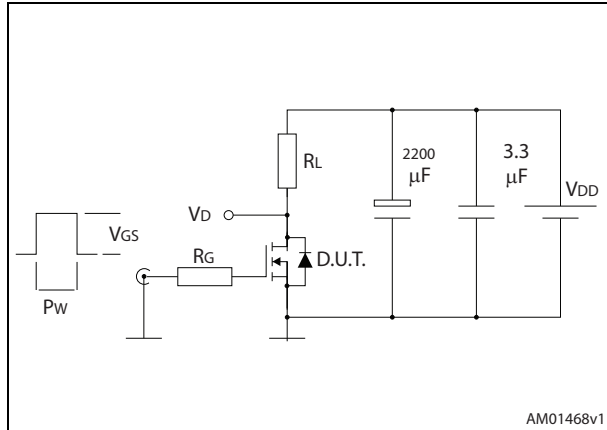


Figure 14. Gate charge test circuit

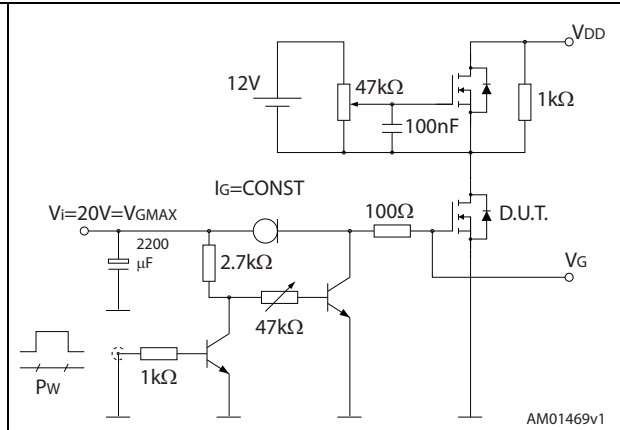


Figure 15. Test circuit for inductive load switching and diode recovery times

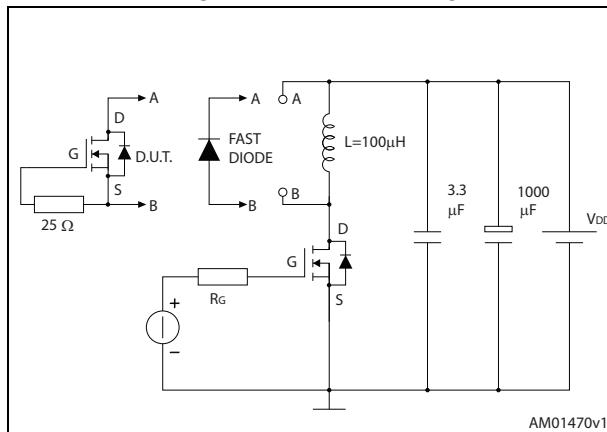


Figure 16. Unclamped inductive load test circuit

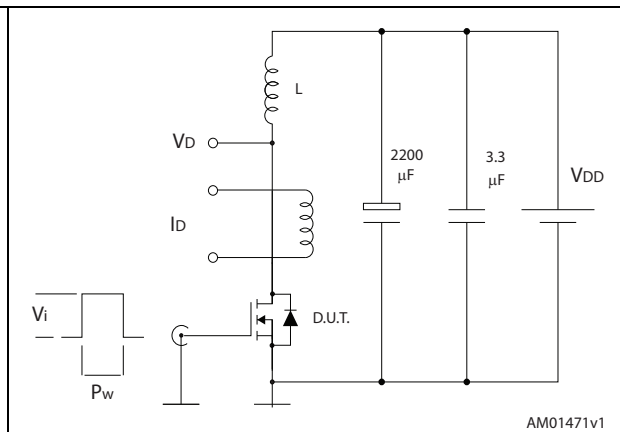


Figure 17. Unclamped inductive waveform

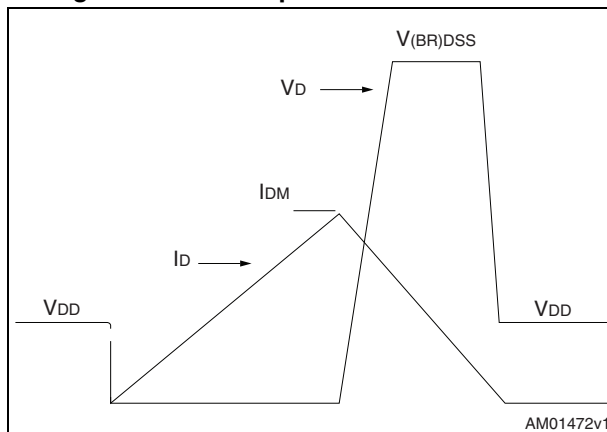
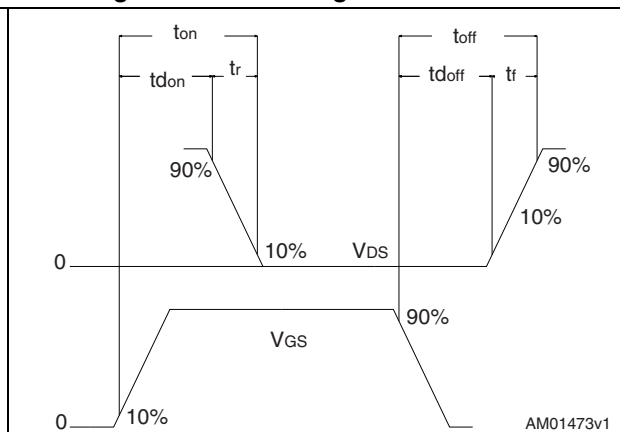


Figure 18. Switching time waveform



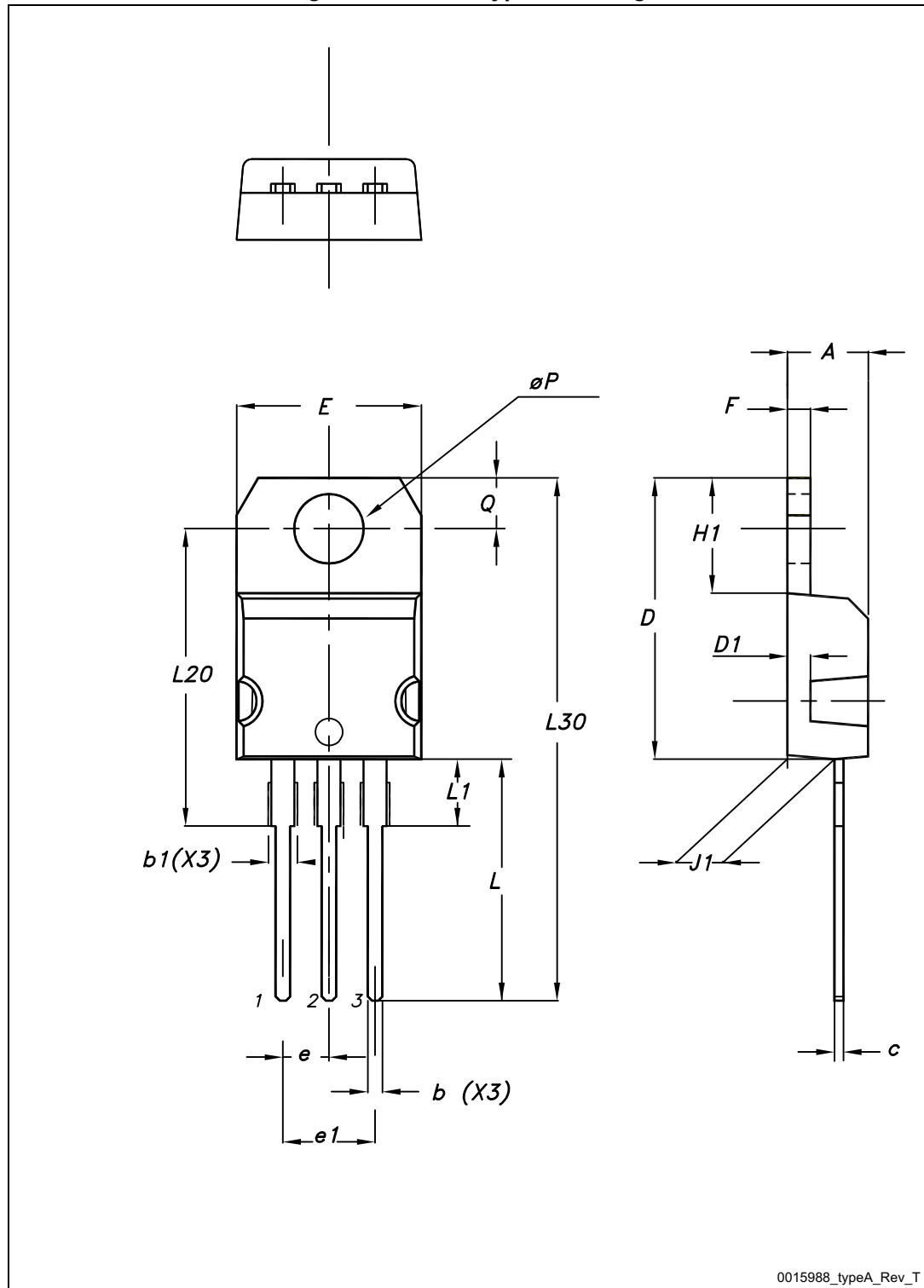
4 Package mechanical data

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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. Table 5 , Table 6 and Table 7 have been updated with typical values.
20-Aug-2012	4	Document status promoted from preliminary to production data. Added Section 2.1: Electrical characteristics (curves) . Minor text changes.
31-Oct-2012	5	– Added: H ² PAK-2 and H ² PAK-6 packages – Updated: Section 4: Package mechanical data and Section 4: Package mechanical data – 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 Table 4 . – Minor text changes – Inserted: E_{AS} value in Table 2

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