

## N-channel 55 V, 4.5 $\Omega$ typ., 110 A STripFET™ F6 Power MOSFET in a TO-220 package

Datasheet - production data

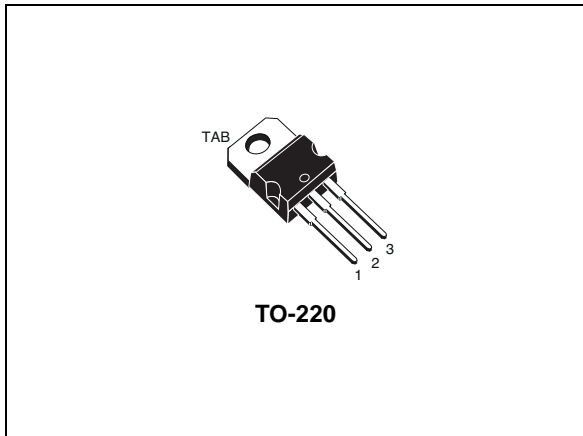
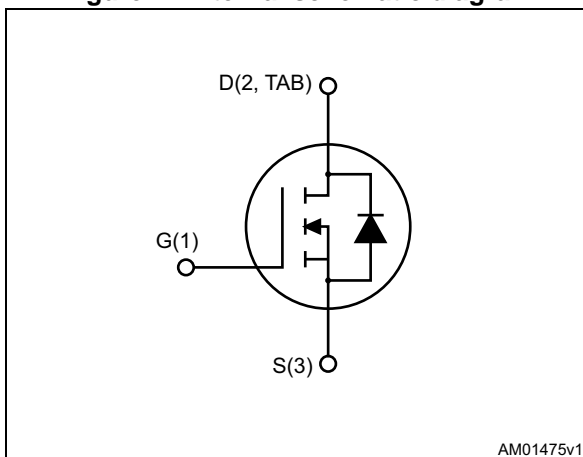


Figure 1. Internal schematic diagram



### Features

Order code	$V_{DS}$	$R_{DS(on)}$ max.	$I_D$
STP110N55F6	55 V	5.2 m $\Omega$	110 A

- Low gate charge
- Very low on-resistance
- High avalanche ruggedness

### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using the STripFET™ F6 technology, with a new trench gate structure. The resulting Power MOSFET exhibits a very low  $R_{DS(on)}$  in all packages.

Table 1. Device summary

Order code	Marking	Packages	Packaging
STP110N55F6	110N55F6	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	55	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	110	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	85	A
$I_{DM}^{(1)}$	Drain current (pulsed)	440	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	150	W
	Derating factor	1	W/ $^\circ\text{C}$
$T_{stg}$	Storage temperature	- 55 to 175	$^\circ\text{C}$
$T_j$	Operating junction temperature		

1. Current limited by package.

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	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	$V_{GS} = 0, I_D = 250\ \mu A$	55			V
$I_{DSS}$	Zero gate voltage Drain current	$V_{GS} = 0, V_{DS} = 55\ V$			1	$\mu A$
		$V_{GS} = 0, V_{DS} = 55\ V, T_C = 125\text{ °C}$			100	$\mu A$
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0, V_{GS} = \pm 20\ V$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu A$	2		4	V
$R_{DS(on)}$	Static drain-source on- resistance	$V_{GS} = 10\ V, I_D = 60\ A$		4.5	5.2	m $\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{GS} = 0, V_{DS} = 25\ V, f = 1\ MHz$	-	7390	-	pF
$C_{oss}$	Output capacitance		-	504	-	pF
$C_{rss}$	Reverse transfer capacitance		-	355	-	pF
$Q_g$	Total gate charge	$V_{DD} = 44\ V, I_D = 110\ A, V_{GS} = 10\ V$ (see Figure 14)	-	126	-	nC
$Q_{gs}$	Gate-source charge		-	32	-	nC
$Q_{gd}$	Gate-drain charge		-	38	-	nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 27.5\ V, I_D = 55\ A, R_G = 4.7\ \Omega, V_{GS} = 10\ V$ (see Figure 13)	-	23	-	ns
$t_r$	Rise time		-	65	-	ns
$t_{d(off)}$	Turn-off-delay time		-	503	-	ns
$t_f$	Fall time		-	237	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$I_{SD}$	Source-drain current		-		110	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		440	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 110 \text{ A}, V_{GS} = 0$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 110 \text{ A}, V_{DD} = 44 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s},$ $T_j = 150 \text{ }^\circ\text{C}$ <i>(see Figure 15)</i>	-	44		ns
$Q_{rr}$	Reverse recovery charge		-	82		nC
$I_{RRM}$	Reverse recovery current		-	3.8		A

1. Current limited by package.
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

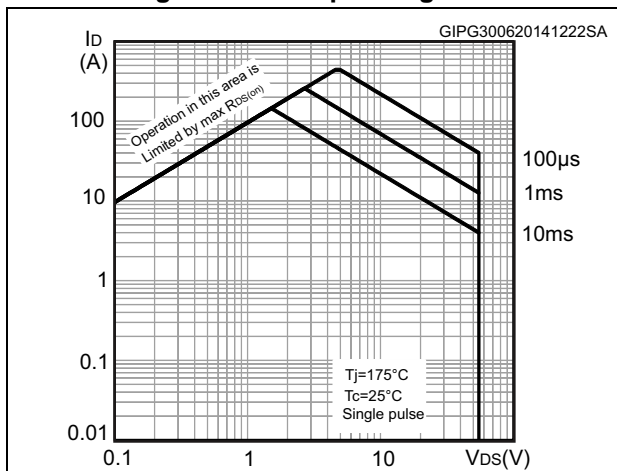


Figure 3. Thermal impedance

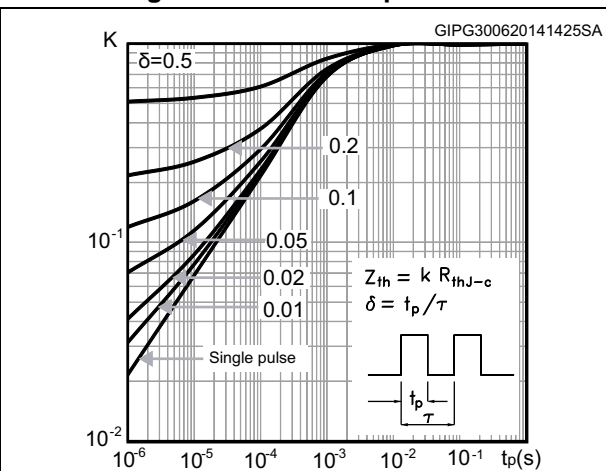


Figure 4. Output characteristics

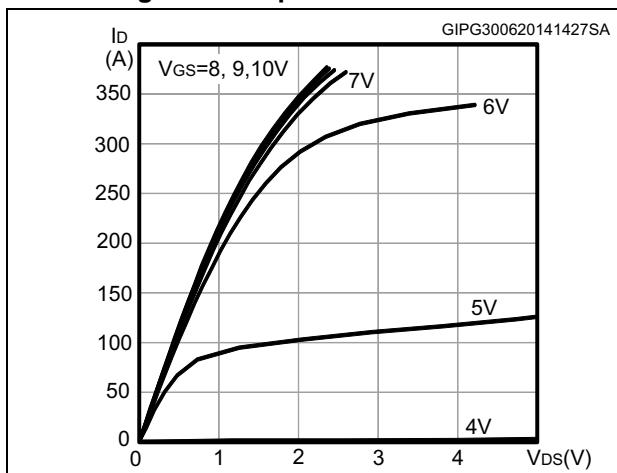


Figure 5. Transfer characteristics

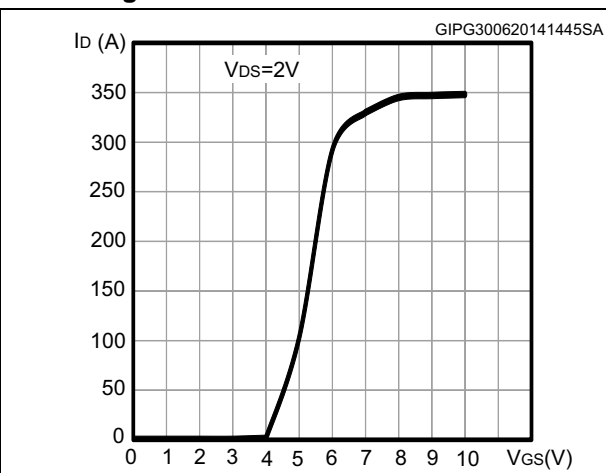


Figure 6. Gate charge vs gate-source voltage

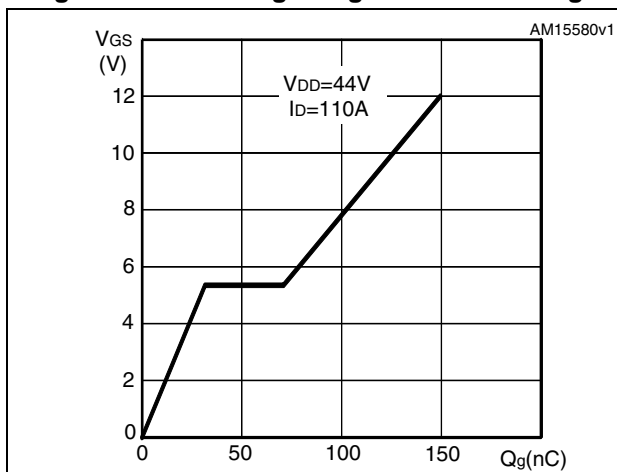


Figure 7. Static drain-source on-resistance

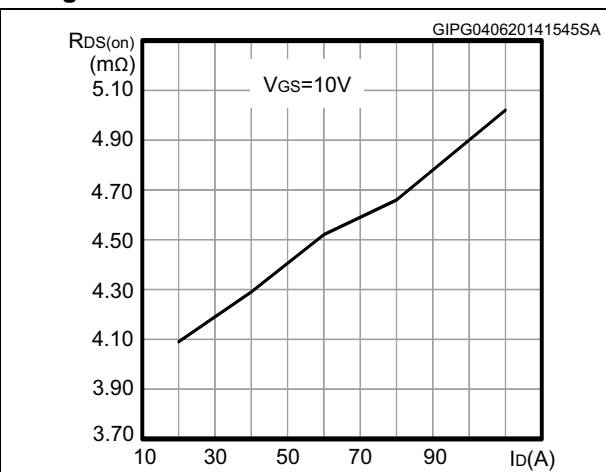


Figure 8. Capacitance variations

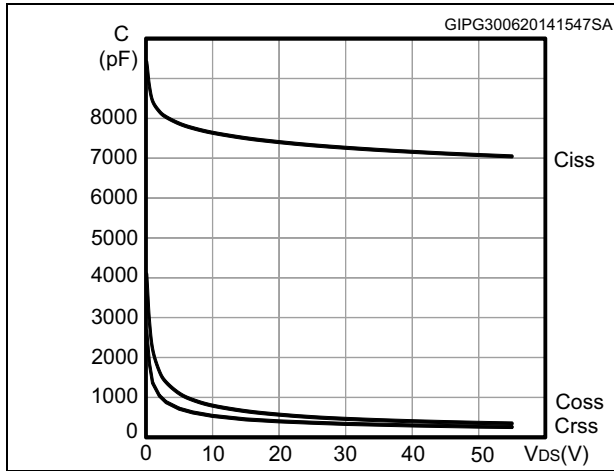


Figure 9. Normalized gate threshold voltage vs temperature

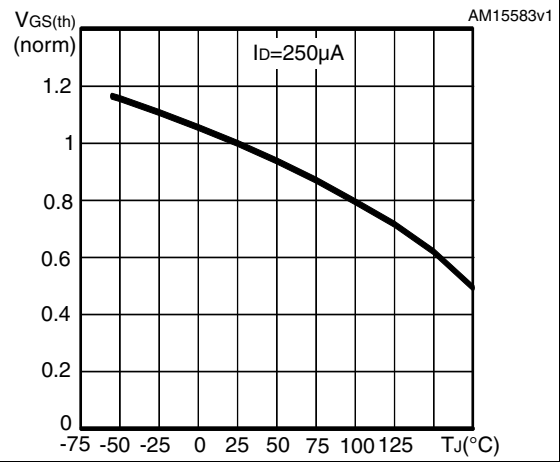


Figure 10. Normalized on-resistance vs temperature

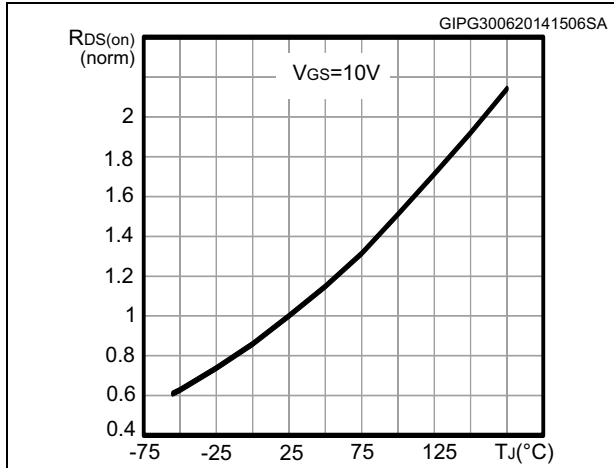


Figure 11. Source-drain diode forward characteristics

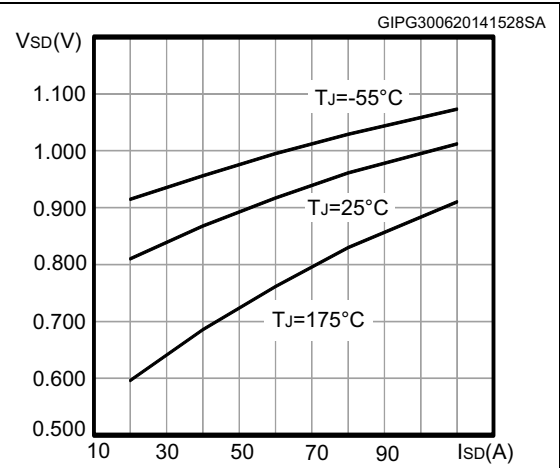
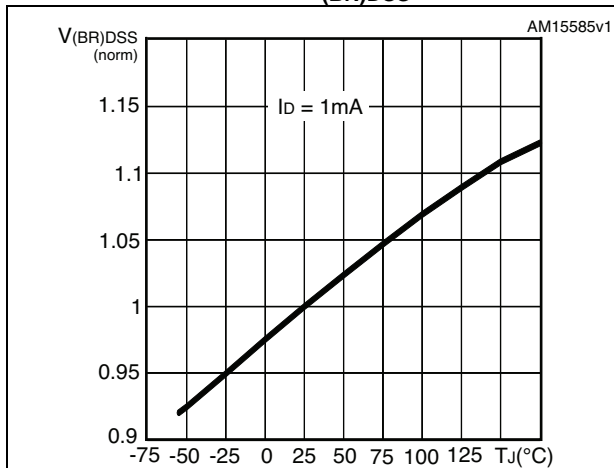


Figure 12. Normalized  $V_{(BR)DSS}$  vs temperature



### 3 Test circuits

Figure 13. Switching times test circuit for resistive load



Figure 14. Gate charge test circuit

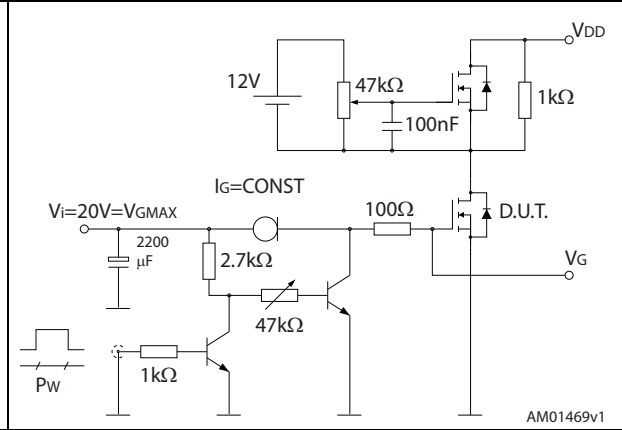


Figure 15. Test circuit for inductive load switching and diode recovery times



Figure 16. Unclamped inductive load test circuit

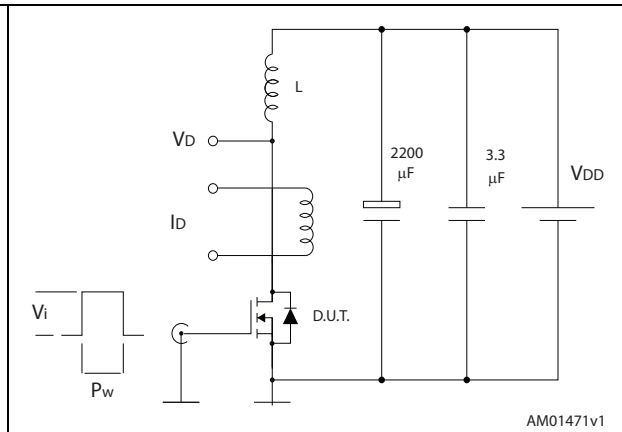


Figure 17. Unclamped inductive waveform

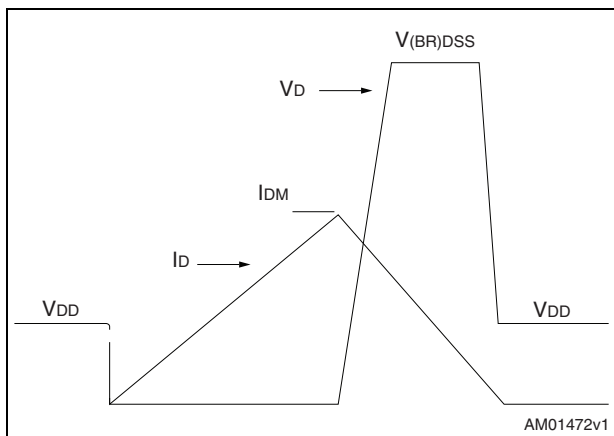
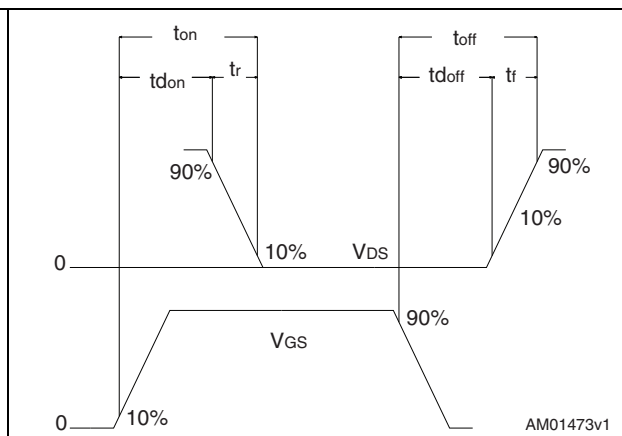


Figure 18. Switching time waveform





## 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 is an ST trademark.

Figure 19. TO-220 type A drawing

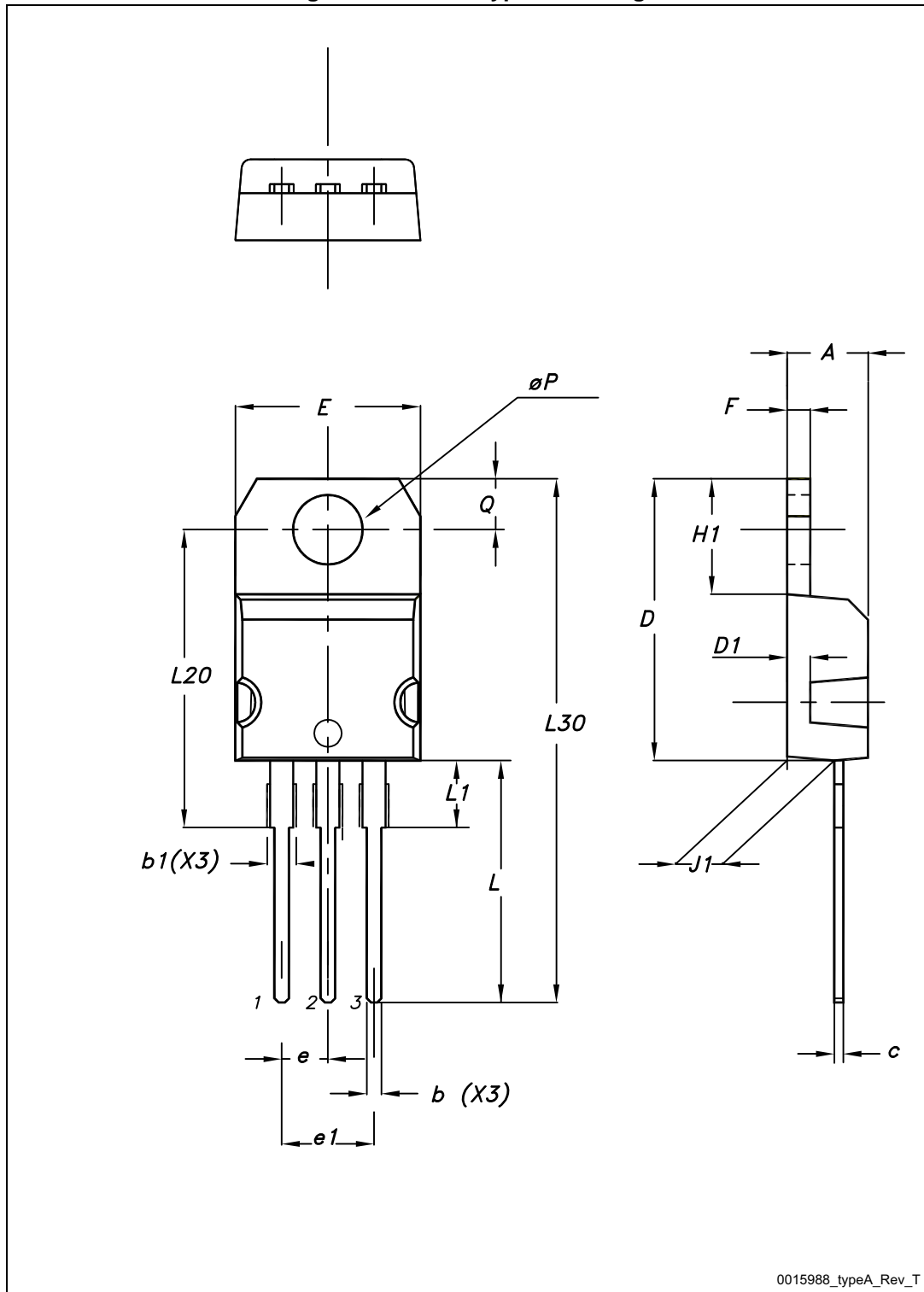


Table 8. TO-220 type A mechanical data

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

## 5 Revision history

Table 9. Document revision history

Date	Revision	Changes
18-Jul-2011	1	First release.
11-Jul-2014	2	<ul style="list-style-type: none"><li>– Modified: title and <i>Description</i></li><li>– Modified: <math>I_D</math> (at <math>T_C = 100\text{ °C}</math>) value in <i>Table 2</i></li><li>– Modified: <math>R_{DS(on)}</math> typical value</li><li>– Modified: the entire typical values in <i>Table 5, 6 and 7</i></li><li>– Added: <i>Section 2.1: Electrical characteristics (curves)</i></li><li>– Updated: <i>Section 4: Package mechanical data</i></li><li>– Minor text changes</li></ul>

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