

N-channel 80 V, 0.003  $\Omega$  typ., 120 A, STripFET™ F7  
Power MOSFET in TO-220 package

Datasheet — production data

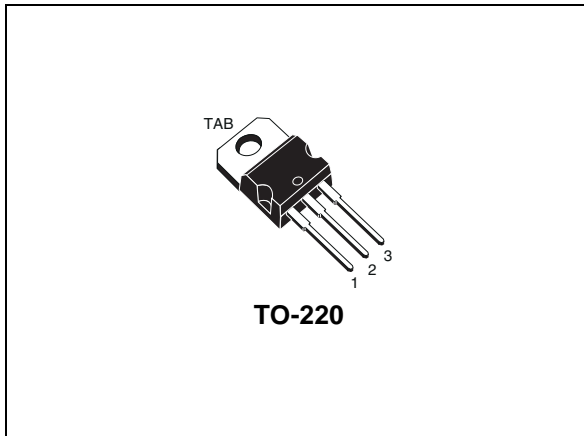
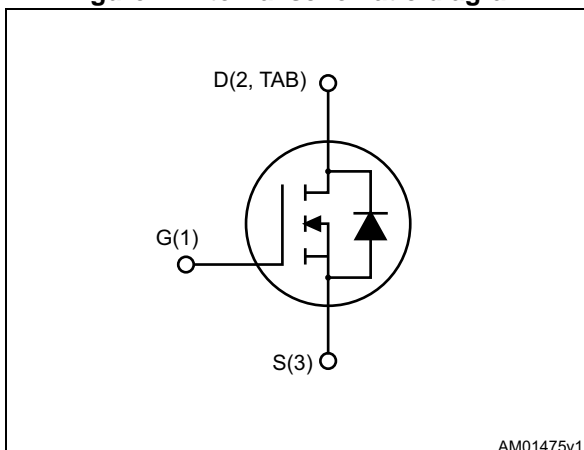


Figure 1. Internal schematic diagram



## Features

Order code	$V_{DS}$	$R_{DS(on)}$ max.	$I_D$	$P_{TOT}$
STP170N8F7	80 V	0.0039 $\Omega$	120 A	250 W

- Among the lowest  $R_{DS(on)}$  on the market
- Excellent figure of merit (FoM)
- Low  $C_{rSS}/C_{iSS}$  ratio for EMI immunity
- High avalanche ruggedness

## Applications

- Switching applications

## Description

This N-channel Power MOSFET utilizes STripFET™ F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1. Device summary

Order code	Marking	Package	Packaging
STP170N8F7	170N8F7	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	80	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous)	120	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	120	A
$I_{DM}$	Drain current (pulsed)	480	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	250	W
$T_J$	Operating junction temperature	-55 to 175	$^\circ\text{C}$
$T_{stg}$	Storage temperature		$^\circ\text{C}$

1. Limited by package and rated according to  $R_{thj-c}$ .

**Table 3. Thermal resistance**

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

**Table 4. Avalanche data**

Symbol	Parameter	Value	Unit
$I_{AV}$	Not-repetitive avalanche current, (pulse width limited by $T_{jmax}$ )	35	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$ , $I_D = I_{AV}$ , $V_{DD} = 50\text{ V}$ )	615	mJ

## 2 Electrical characteristics

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

**Table 5. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 250\ \mu A$	80			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 80\ V$			1	$\mu A$
		$V_{GS} = 0, V_{DS} = 80\ V, T_C = 125\text{ °C}$			100	$\mu A$
$I_{GSS}$	Gate body leakage current	$V_{DS} = 0, V_{GS} = +20\ V$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu A$	2.5		4.5	V
$R_{DS(on)}$	Static drain-source on- resistance	$V_{GS} = 10\ V, I_D = 60\ A$		0.003	0.0039	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{GS} = 0, V_{DS} = 40\ V, f = 1\ MHz$	-	8710	-	pF
$C_{oss}$	Output capacitance		-	1330	-	pF
$C_{rss}$	Reverse transfer capacitance		-	78	-	pF
$Q_g$	Total gate charge	$V_{DD} = 40\ V, I_D = 120\ A$	-	120	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10\ V$	-	43	-	nC
$Q_{gd}$	Gate-drain charge	<a href="#">Figure 14</a>	-	26	-	nC

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 40\ V, I_D = 60\ A, R_G = 4.7\ \Omega, V_{GS} = 10\ V$ <a href="#">Figure 13</a>	-	38	-	ns
$t_r$	Rise time		-	53	-	ns
$t_{d(off)}$	Turn-off delay time		-	79	-	ns
$t_f$	Fall time		-	37	-	ns

Table 8. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		120	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		480	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS}=0, I_{SD} = 120 \text{ A}$	-		1.2	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 120 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 64 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$	-	54		ns
$Q_{rr}$	Reverse recovery charge		-	78		nC
$I_{RRM}$	Reverse recovery current		-	2.9		A

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

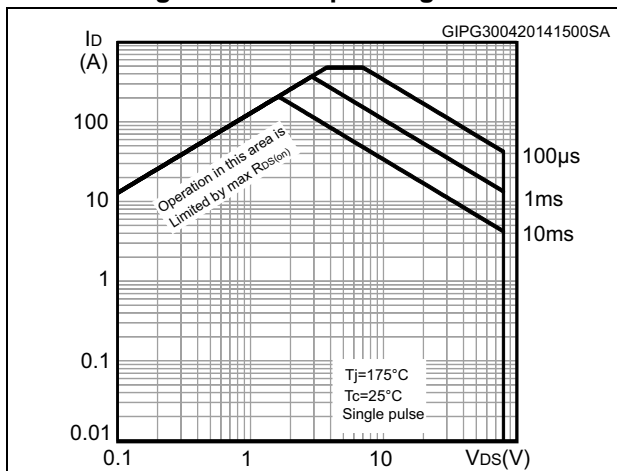


Figure 3. Thermal impedance

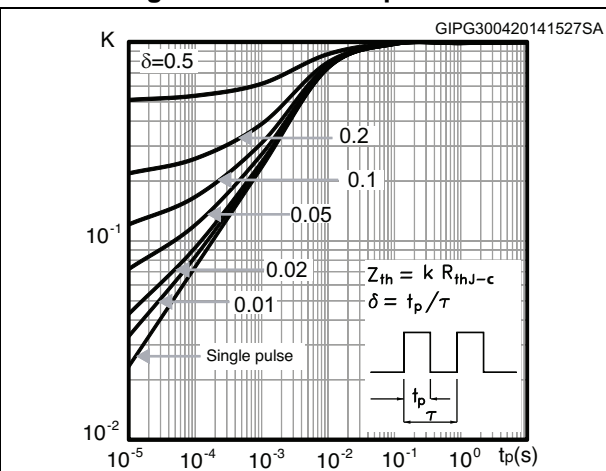


Figure 4. Output characteristics

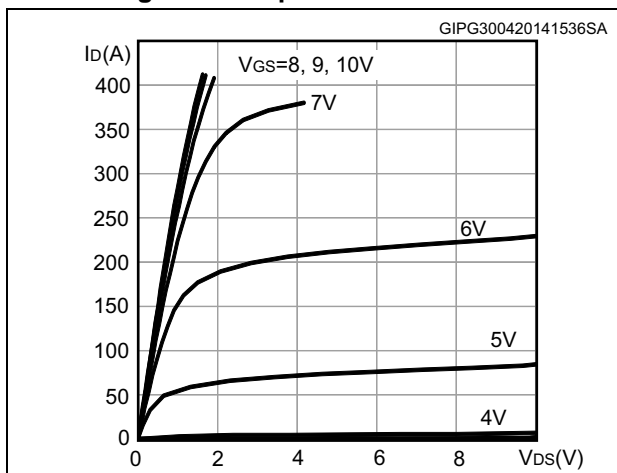


Figure 5. Transfer characteristics

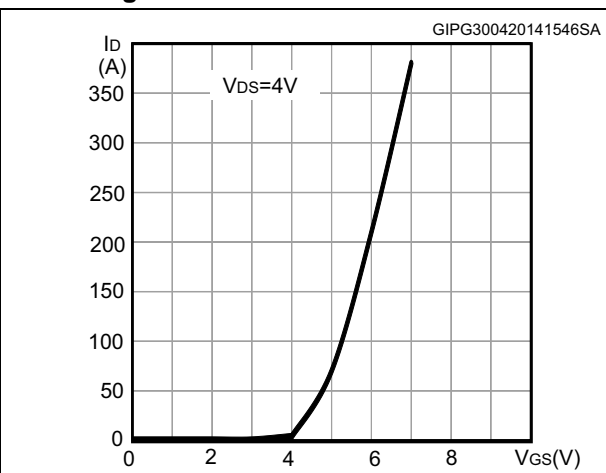


Figure 6. Gate charge vs gate-source voltage

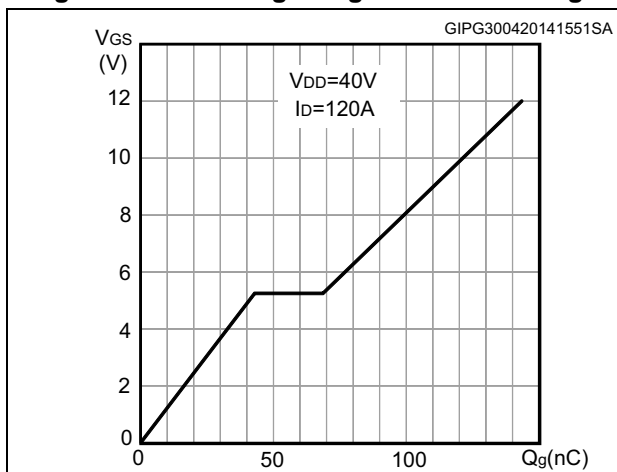


Figure 7. Static drain-source on-resistance

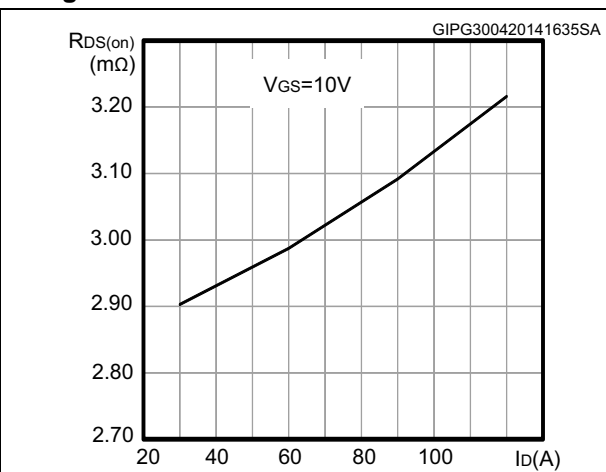


Figure 8. Capacitance variations

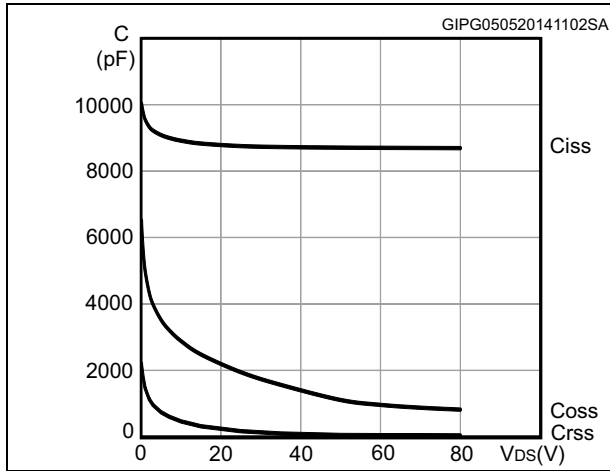


Figure 9. Normalized gate threshold voltage vs temperature

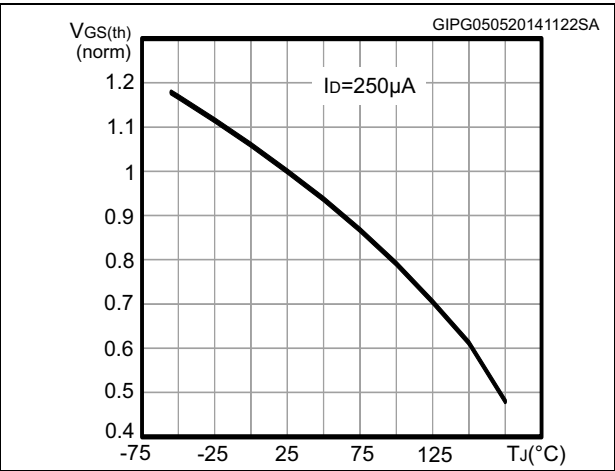


Figure 10. Normalized on-resistance vs temperature

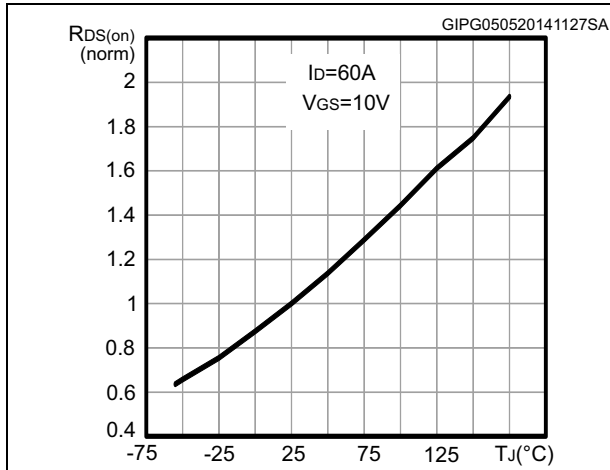


Figure 11. Normalized  $V_{(BR)DSS}$  vs temperature

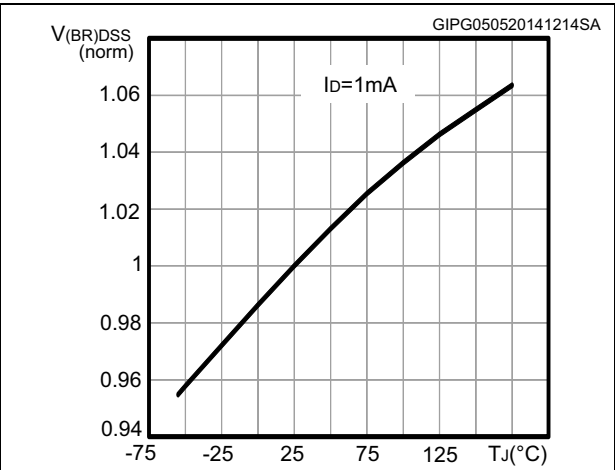
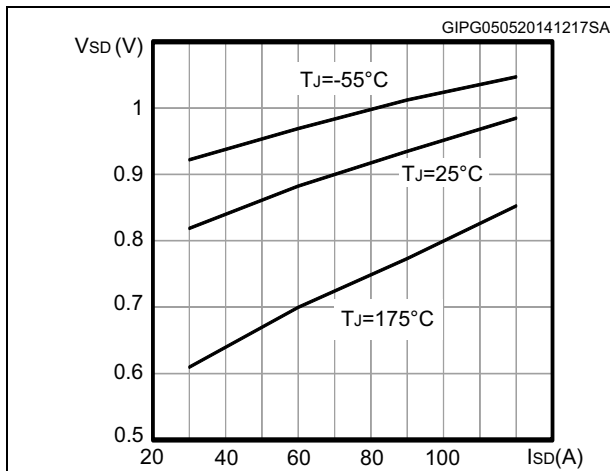


Figure 12. Source-drain diode forward characteristics



### 3 Test circuits

Figure 13. Switching times test circuit for resistive load



Figure 14. Gate charge test circuit

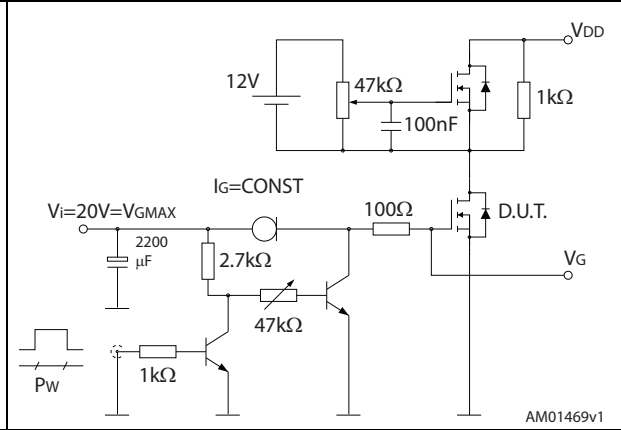


Figure 15. Test circuit for inductive load switching and diode recovery times



Figure 16. Unclamped inductive load test circuit

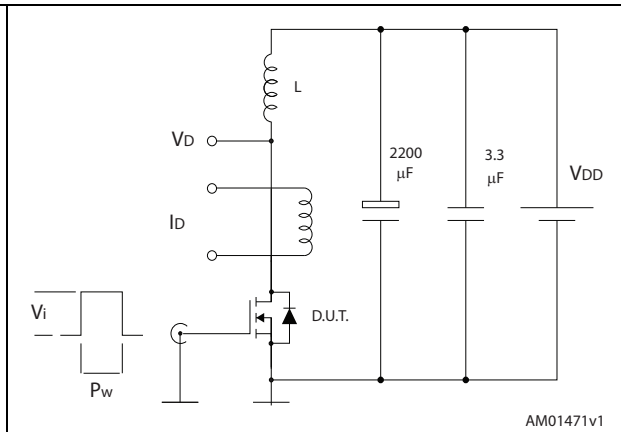


Figure 17. Unclamped inductive waveform

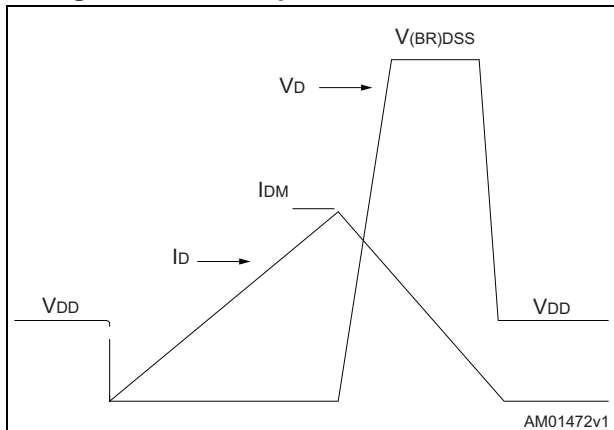
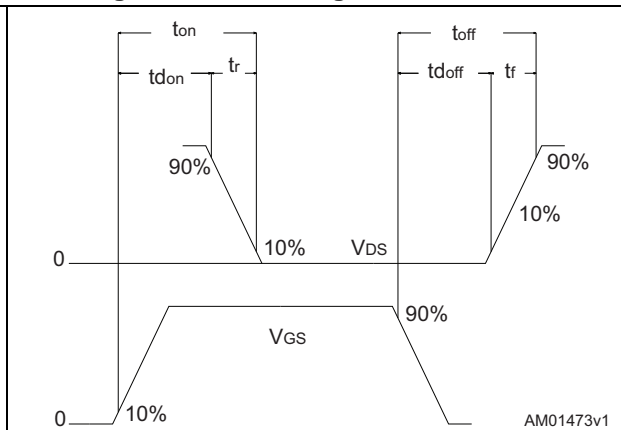


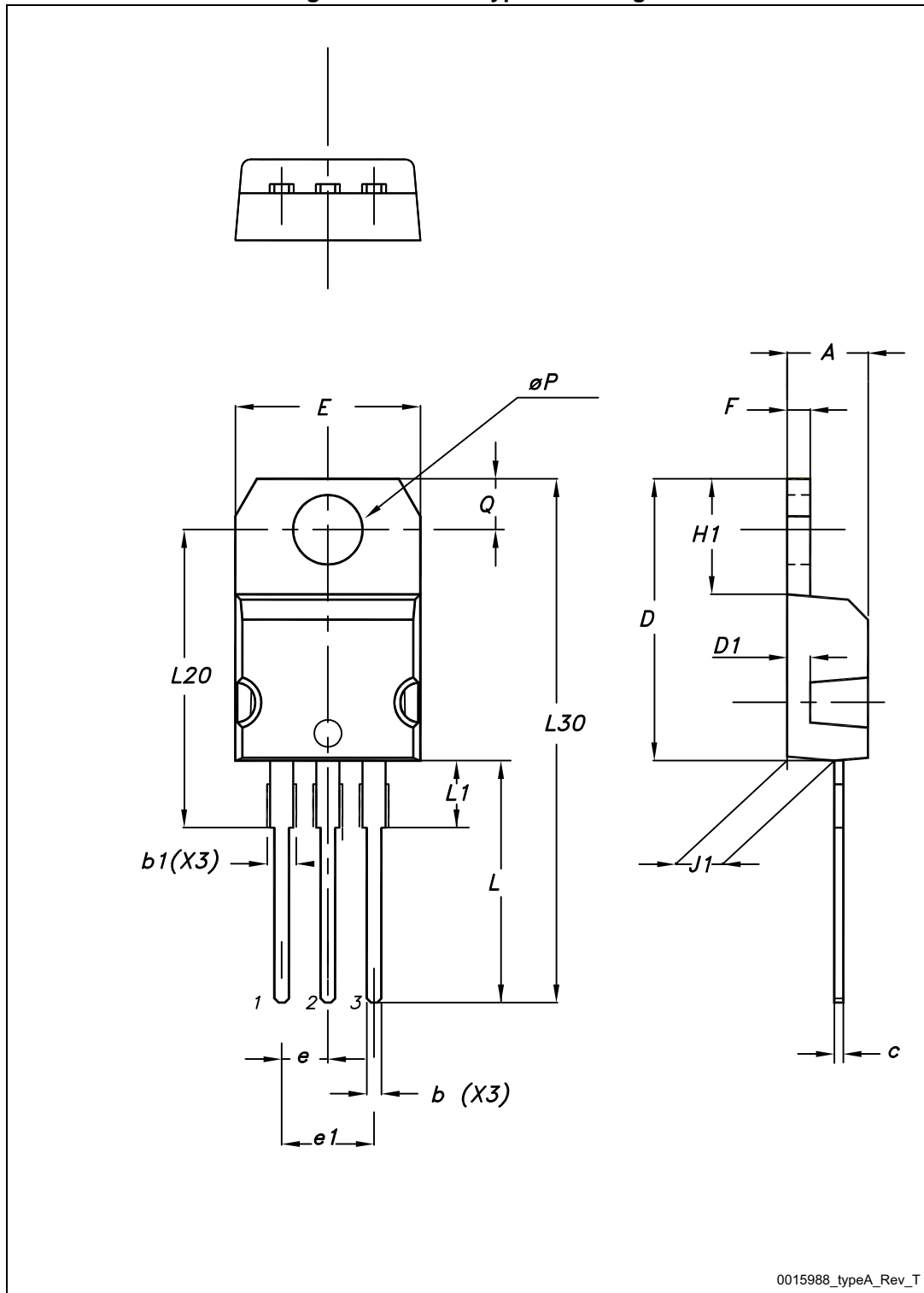
Figure 18. Switching time waveform





# 4 Package mechanical data

Figure 19. TO-220 type A drawing



0015988\_typeA\_Rev\_T

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		1.70
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 10. Document revision history**

Date	Revision	Changes
16-Apr-2013	1	First release.
15-May-2014	2	<ul style="list-style-type: none"> <li>– The part number STH170N8F7-2 has been moved to a separate datasheet</li> <li>– Modified: <math>R_{DS(on)}</math> in cover page</li> <li>– Modified: <a href="#">Figure 1</a></li> <li>– Modified: <math>I_D</math> (<math>T_C = 100\text{ °C}</math>), <math>P_{TOT}</math> and <math>E_{AS}</math> values in <a href="#">Table 2</a></li> <li>– Modified: <math>R_{thj-case}</math> value in <a href="#">Table 3</a></li> <li>– Added: <a href="#">Table 4</a></li> <li>– Modified: <math>I_{DSS}</math>, <math>V_{GS(th)}</math> and <math>R_{DS(on)}</math> values in <a href="#">Table 5</a></li> <li>– Modified: the entire typical values in table <a href="#">Table 6</a>, <a href="#">7</a> and <a href="#">8</a></li> <li>– Added: <a href="#">Section 2.1: Electrical characteristics (curves)</a></li> <li>– Updated: <a href="#">Section Figure 19.: TO-220 type A drawing</a></li> <li>– Minor text changes</li> </ul>
20-Feb-2015	3	– Updated title, features and description in cover page.

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