

N-channel 100 V, 5.1 mΩ typ., 110 A, STripFET™ VII DeepGATE™
Power MOSFETs in TO-220FP and TO-220 packages

Datasheet - production data

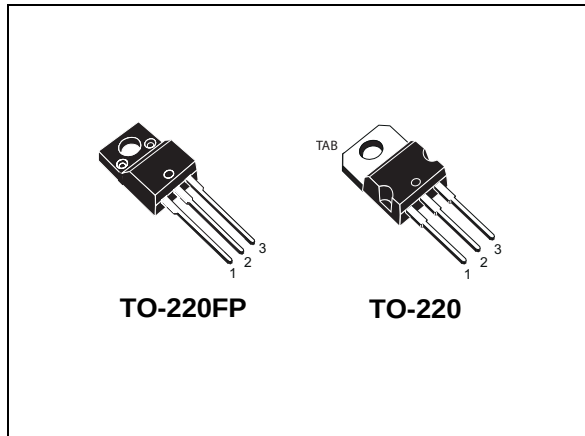
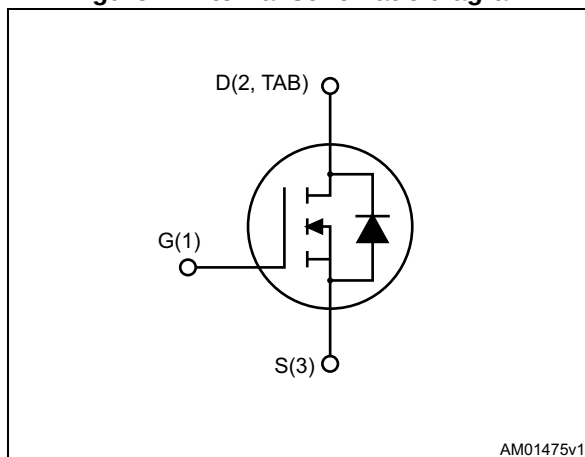


Figure 1. Internal schematic diagram



Features

Order codes	V _{DS}	R _{DS(on)} max	I _D	P _{TOT}
STF110N10F7	100 V	0.007 Ω	45 A	30 W
STP110N10F7			110 A	150 W

- Ultra low on-resistance
- 100% avalanche tested

Applications

- Switching applications

Description

These devices utilize 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
STF110N10F7	110N10F7	TO-220FP	Tube
STP110N10F7		TO-220	

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220FP	TO-220	
V_{DS}	Drain-source voltage	100		V
V_{GS}	Gate-source voltage	± 20		V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	45	110	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	32	76	A
$I_{DM}^{(2)}$	Drain current (pulsed)	180	415	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	30	150	W
$E_{AS}^{(3)}$	Single pulse avalanche energy	490		mJ
T_J	Operating junction temperature	-55 to 175		$^{\circ}\text{C}$
T_{stg}	Storage temperature			$^{\circ}\text{C}$

1. This value is rated according to R_{thj-c} .

2. Limited by safe operating area.

3. Starting $T_J=25\text{ }^{\circ}\text{C}$, $I_D=18$, $V_{DD}=50\text{ V}$.

Table 3. Thermal resistance

Symbol	Parameter	Value		Unit
		TO-220FP	TO-220	
$R_{thj-case}$	Thermal resistance junction-case	5.00	1.00	$^{\circ}\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-amb	62.50		$^{\circ}\text{C/W}$

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
		$V_{DS} = 100\text{ V}; T_C=125\text{ }^{\circ}\text{C}$			10	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		4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	For TO-220FP: $V_{GS}=10\text{ V}, I_D=22.5\text{ A}$		5.1	7	m Ω
		For TO-220: $V_{GS}=10\text{ V}, I_D=55\text{ A}$				

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS}=50\text{ V}, f=1\text{ MHz}, V_{GS}=0$	-	5117	-	pF
C_{oss}	Output capacitance		-	992	-	pF
C_{rss}	Reverse transfer capacitance		-	39	-	pF
Q_g	Total gate charge	$V_{DD}=50\text{ V}, I_D = 110\text{ A}$ $V_{GS}=10\text{ V}$ Figure 17	-	72	-	nC
Q_{gs}	Gate-source charge		-	31	-	nC
Q_{gd}	Gate-drain charge		-	16	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD}=50\text{ V}, I_D = 55\text{ A},$ $R_G=4.7\text{ }\Omega, V_{GS}=10\text{ V}$ Figure 16	-	25	-	ns
t_r	Rise time		-	36	-	ns
$t_{d(off)}$	Turn-off delay time		-	52	-	ns
t_f	Fall time		-	21	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
I_{SD}	Source-drain current: For TO-220FP		-		45	A
	For TO-220		-		110	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed): For TO-220FP		-		180	A
	For TO-220		-		415	A
$V_{SD}^{(2)}$	Forward on voltage	For TO-220FP: $I_{SD} = 22.5\text{ A}$, $V_{GS}=0$	-		1.2	V
		For TO-220: $I_{SD} = 55\text{ A}$, $V_{GS}=0$				
t_{rr}	Reverse recovery time	$I_{SD} = 110\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD}=80\text{ V}$, $T_J=150\text{ }^\circ\text{C}$	-	77		ns
Q_{rr}	Reverse recovery charge		-	150		nC
I_{RRM}	Reverse recovery current		-	4.3		A

1. Pulse width limited by safe operating area.

2. Pulsed: pulse duration=300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220FP

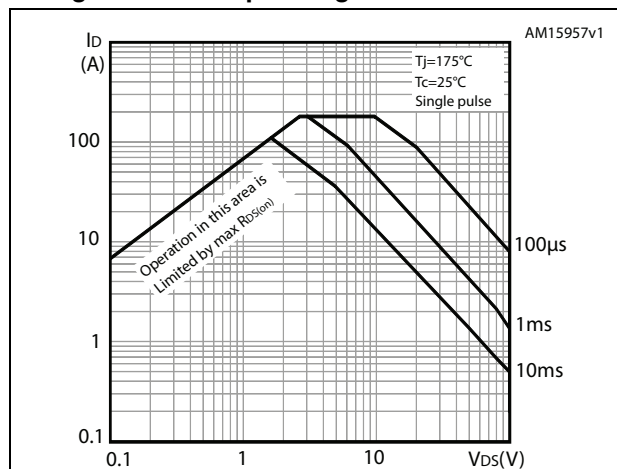


Figure 3. Thermal impedance for TO-220FP

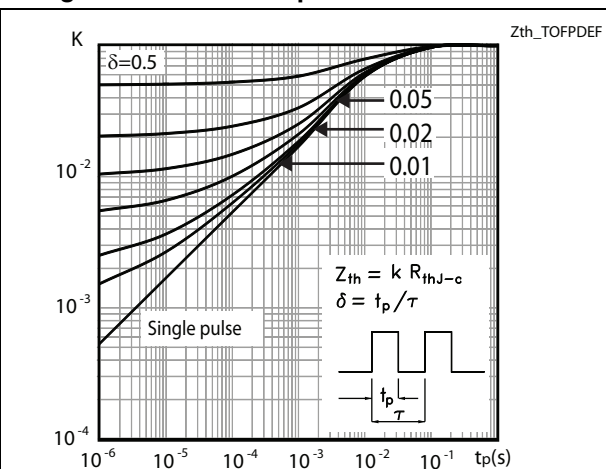


Figure 4. Safe operating area for TO-220

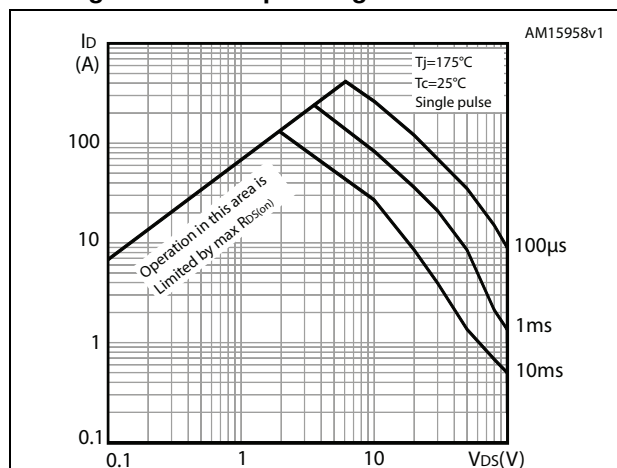


Figure 5. Thermal impedance for TO-220

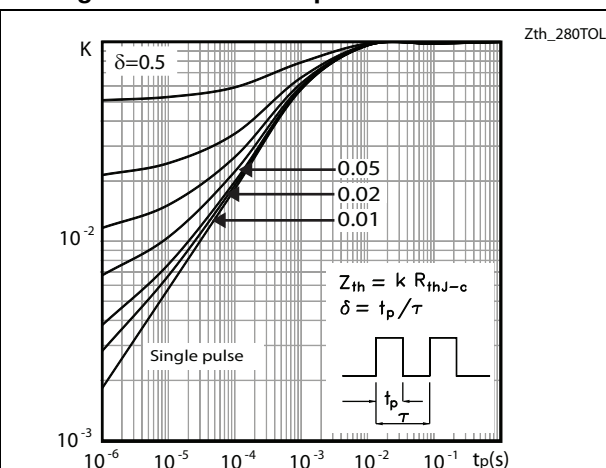


Figure 6. Output characteristics

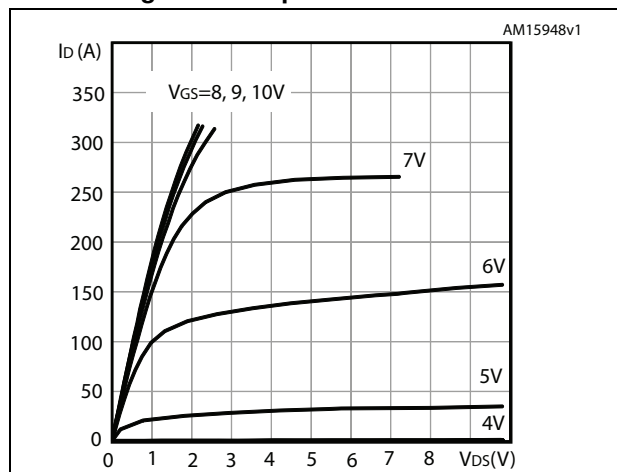


Figure 7. Transfer characteristics

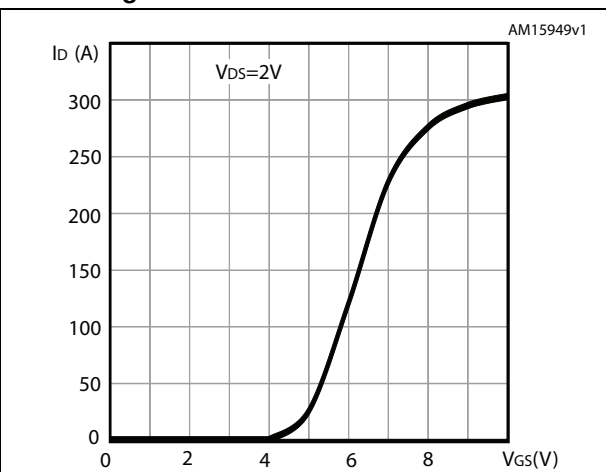


Figure 8. Gate charge vs gate-source voltage

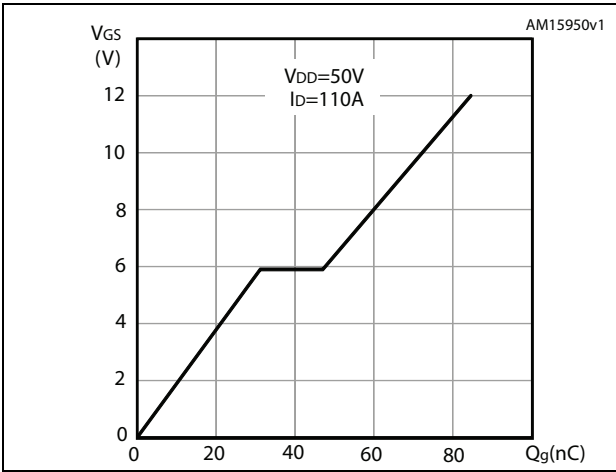


Figure 9. Static drain-source on-resistance for TO-220FP

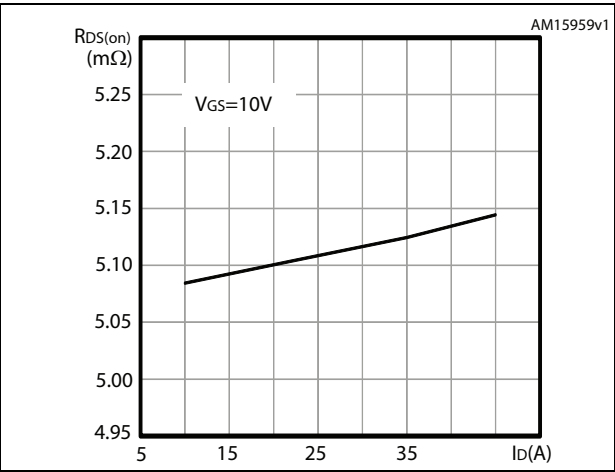


Figure 10. Static drain-source on-resistance for TO-220

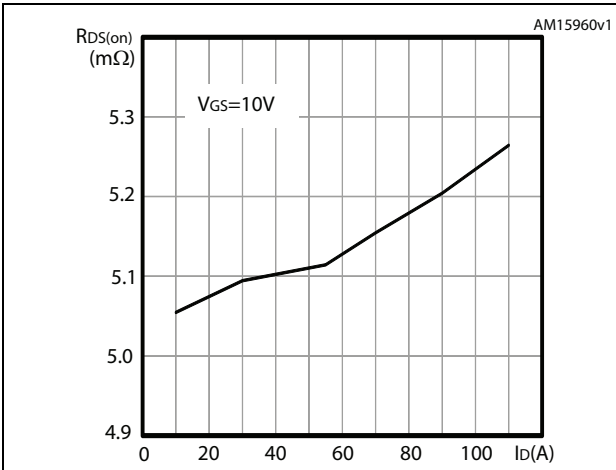


Figure 11. Capacitance variations

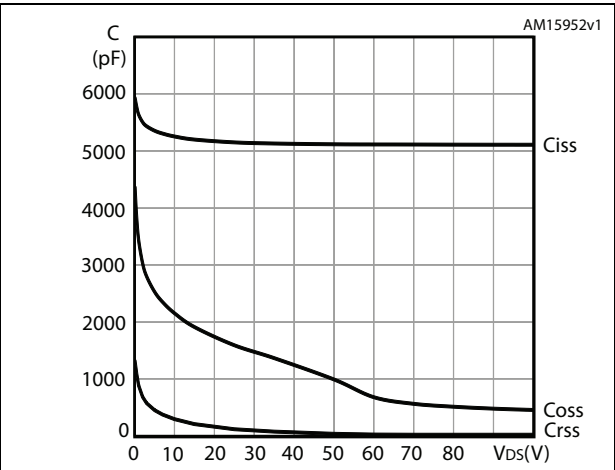


Figure 12. Normalized gate threshold voltage vs temperature

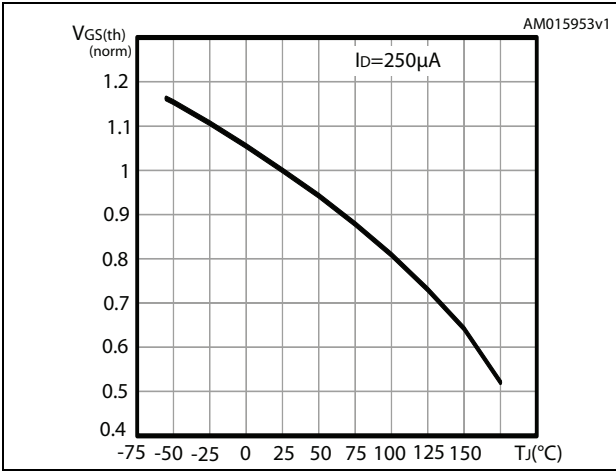


Figure 13. Normalized on-resistance vs temperature

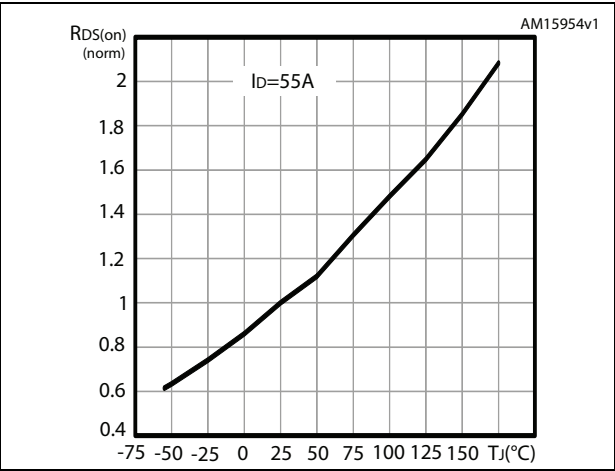


Figure 14. Normalized B_{VDSS} vs temperature

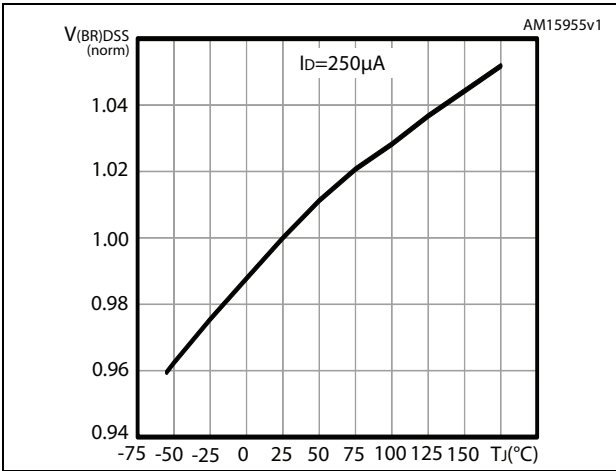
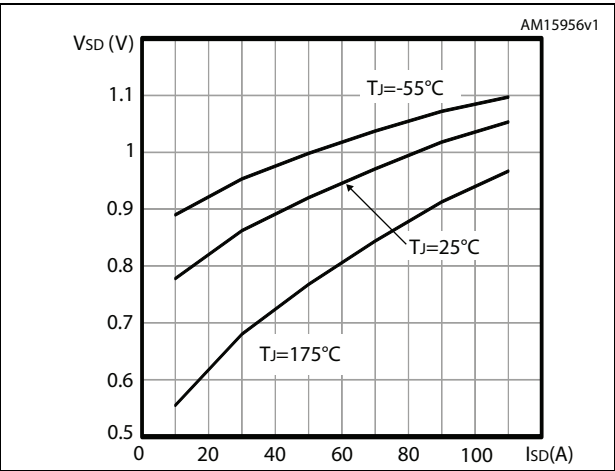


Figure 15. Source-drain diode forward vs temperature



3 Test circuits

Figure 16. Switching times test circuit for resistive load

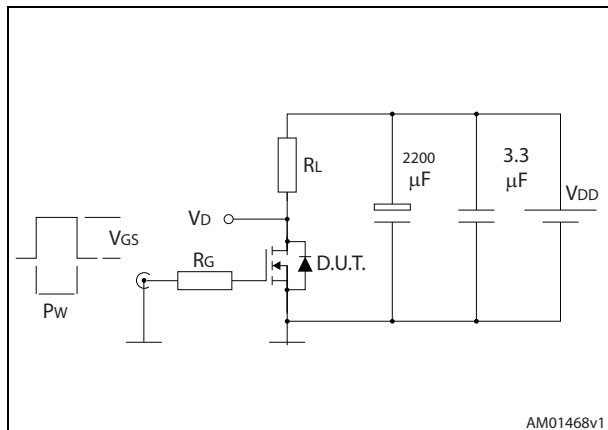


Figure 17. Gate charge test circuit

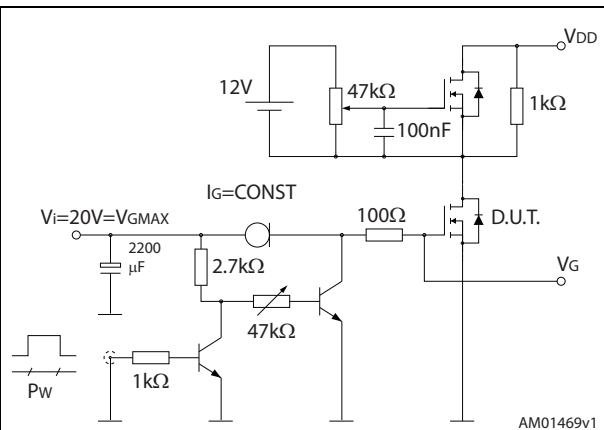


Figure 18. Test circuit for inductive load switching and diode recovery times

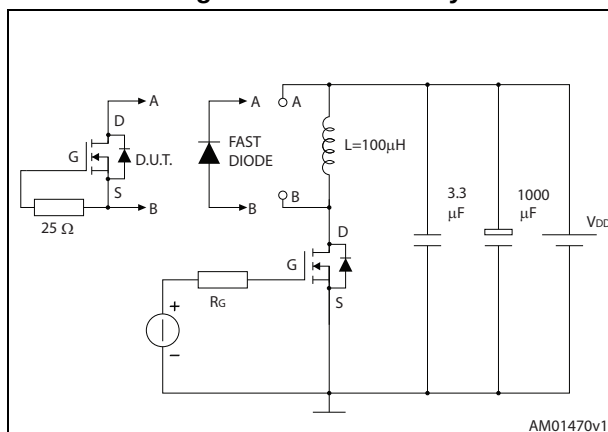


Figure 19. Unclamped inductive load test circuit

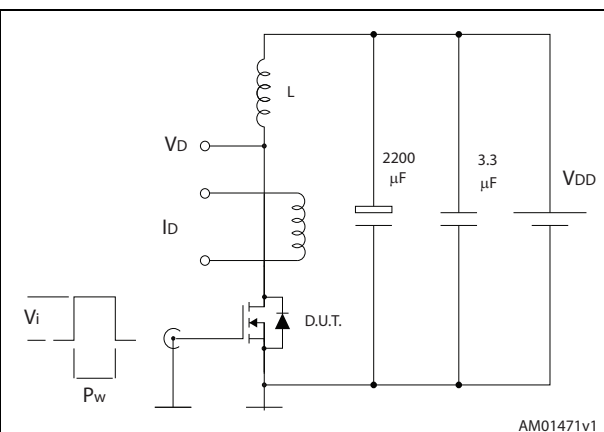


Figure 20. Unclamped inductive waveform

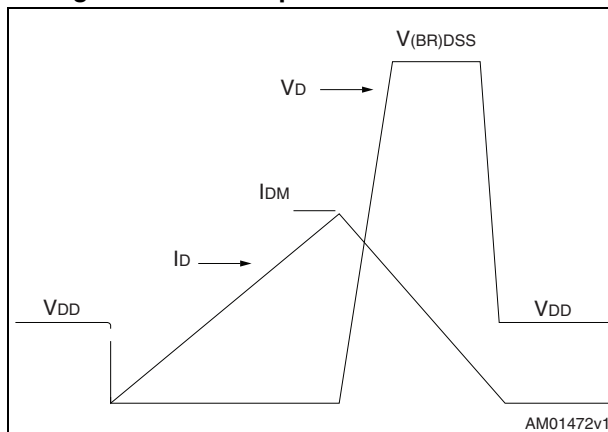
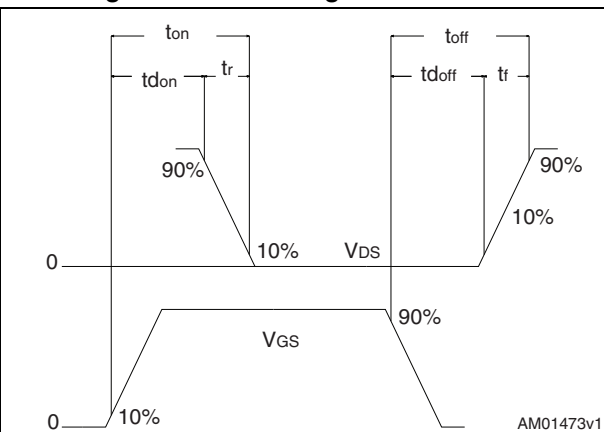


Figure 21. Switching time waveform



4 Package mechanical data

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. ECOPACK® is an ST trademark.

Table 8. TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

Figure 22. TO-220FP drawing

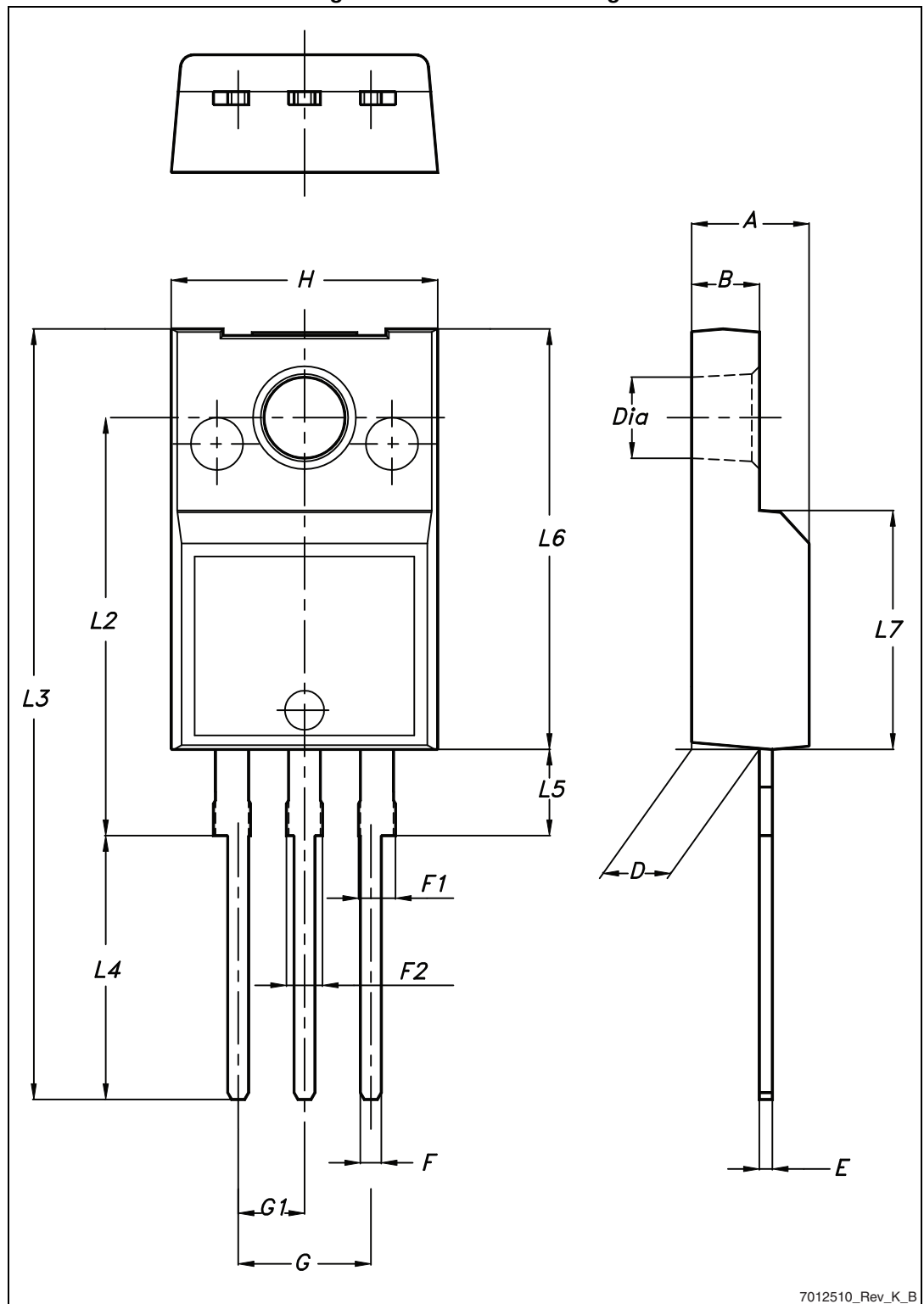
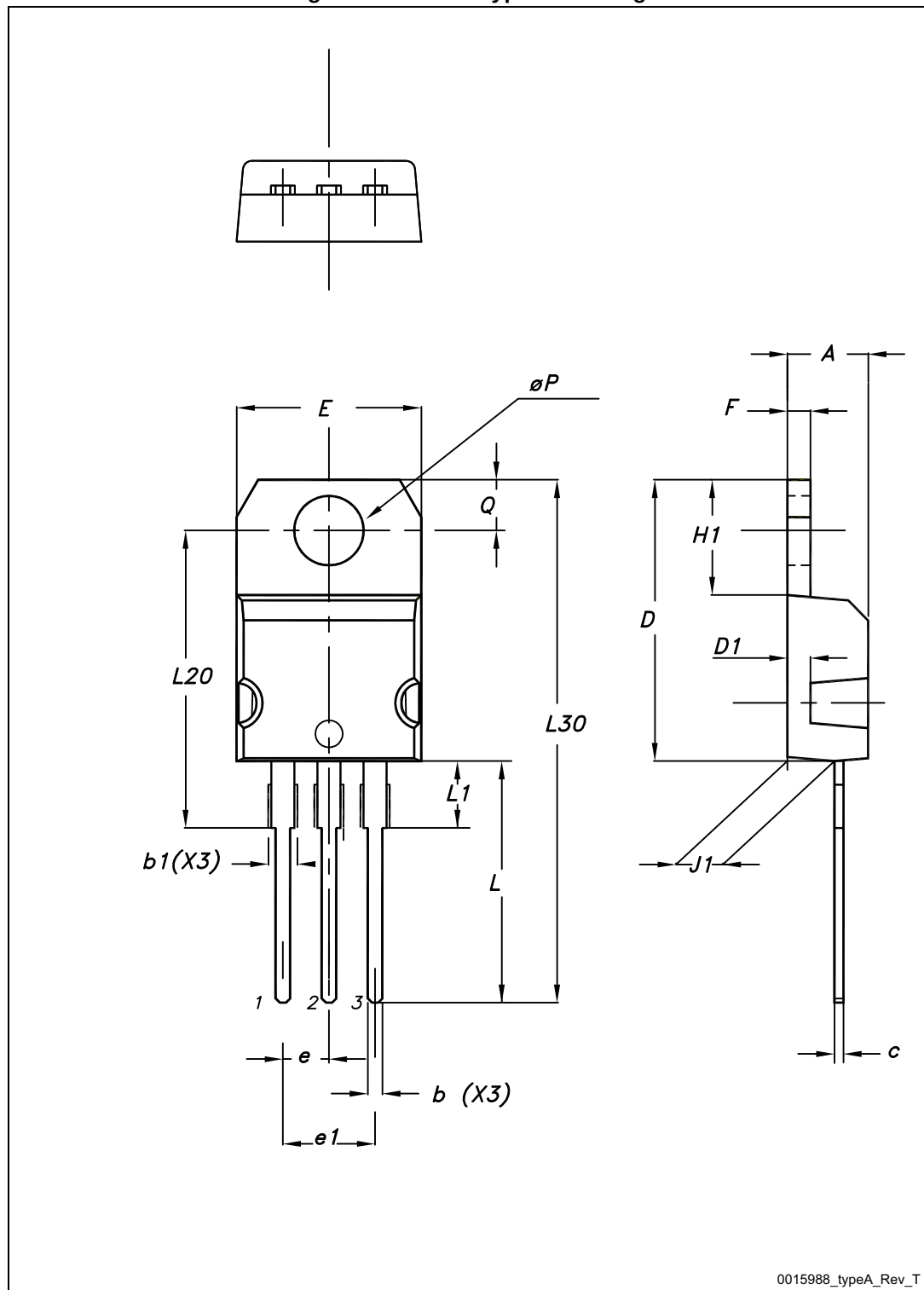


Table 9. TO-220 type A mechanical data

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

Figure 23. TO-220 type A drawing



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
03-Dec-2012	1	Initial release.
16-Jul-2013	2	– Part numbers (STF45N10F7 and STH110N10F7-2) have been moved to two separate datasheets – Modified: title, I_{DM} value for TO-220 – Added: E_{AS} – Modified: the entire typical values in Table 5 and 6 – Modified: typical and max values in Table 7 – Modified: Figure 16, 17, 18, 19, Table 9 and Figure 23 – Minor text changes

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