STF110N10F7, STP110N10F7

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

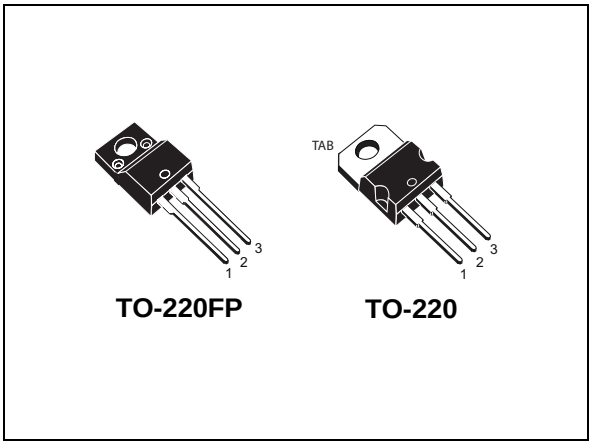
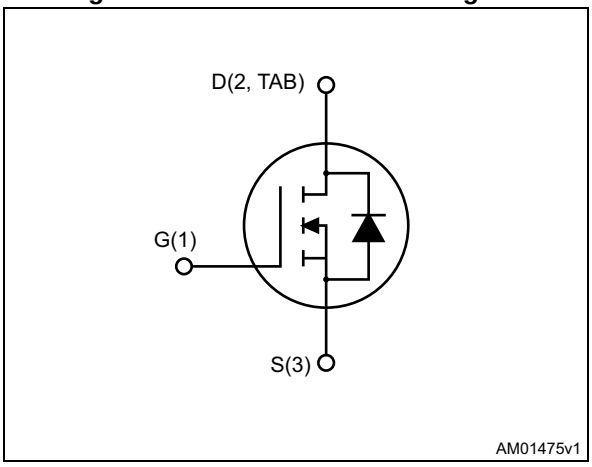


Figure 1. Internal schematic diagram



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	

This is information on a product in full production. www.st.com

Contents

1 Electrical ratings 3

2 Electrical characteristics 4

2.1 Electrical characteristics (curves) 6

3 Test circuits 9

4 Package mechanical data 10

5 Revision history 15

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 °C	45	110	A
I_D (1)	Drain current (continuous) at T_C = 100 °C	32	76	A
I_{DM} (2)	Drain current (pulsed)	180	415	A
P_{TOT} (1)	Total dissipation at T_c = 25 °C	30	150	W
E_{AS} (3)	Single pulse avalanche energy	490		mJ
T_J	Operating junction temperature	-55 to 175		°C
T_{stg}	Storage temperature			°C

1. This value is rated according to $R_{thj\text{-}c}$.
2. Limited by safe operating area.
3. Starting T_J=25 °C, I_D=18, V_{DD}=50 V.

Table 3. Thermal resistance

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

2 Electrical characteristics

(T_{CASE}=25 °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 µA	100		-	V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 100 V			1	µA
		V_{DS} = 100 V; T_C=125 °C			10	µA
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 µA	2.5		4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	For TO-220FP: V_{GS}= 10 V, I_D= 22.5 A		5.1	7	mΩ
		For TO-220: V_{GS}= 10 V, I_D= 55 A				

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} =50 V, f=1 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 V, I_D = 110 A V_{GS} =10 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 V, I_D= 55 A, R_G=4.7 Ω, V_{GS}= 10 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 A, V_{GS}=0	-		1.2	V
		For TO-220: I_{SD} = 55 A, V_{GS}=0				
t_{rr}	Reverse recovery time	I_{SD} = 110 A, di/dt = 100 A/µs, V_{DD}=80 V, T_j=150 °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

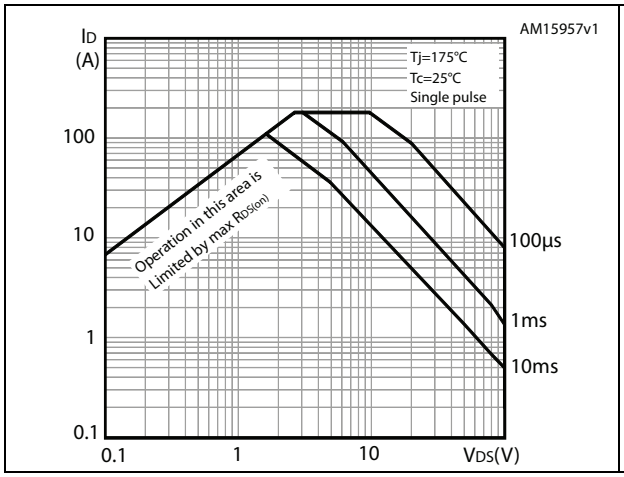


Figure 3. Thermal impedance for TO-220FP

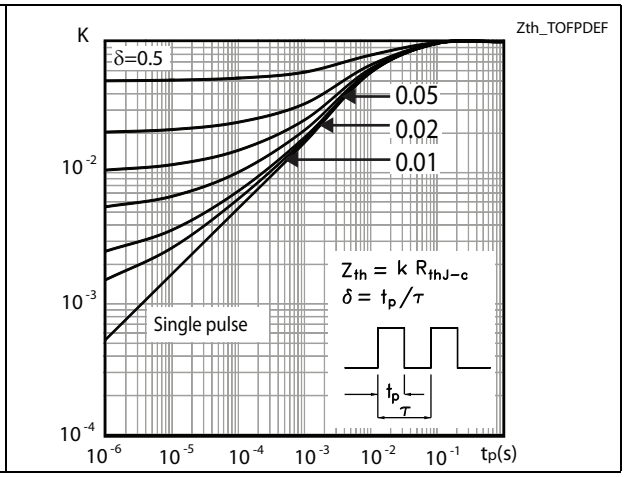


Figure 4. Safe operating area for TO-220

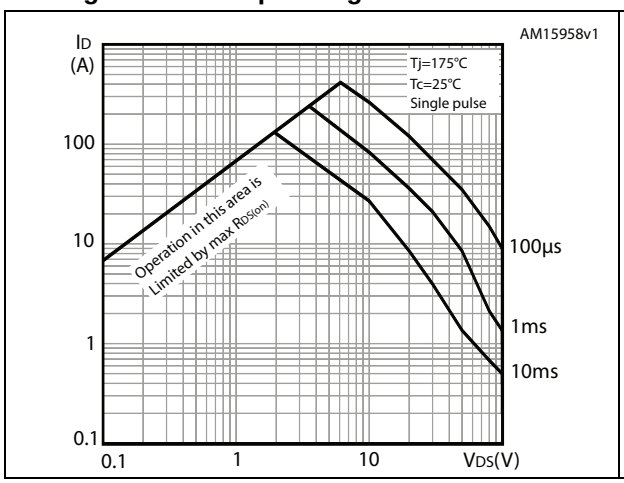


Figure 5. Thermal impedance for TO-220

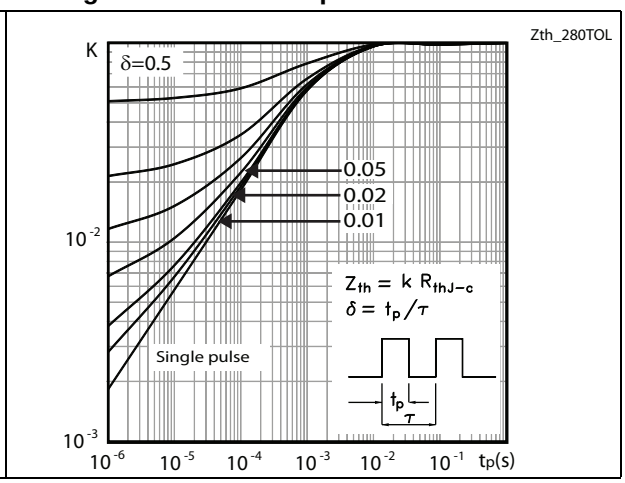


Figure 6. Output characteristics

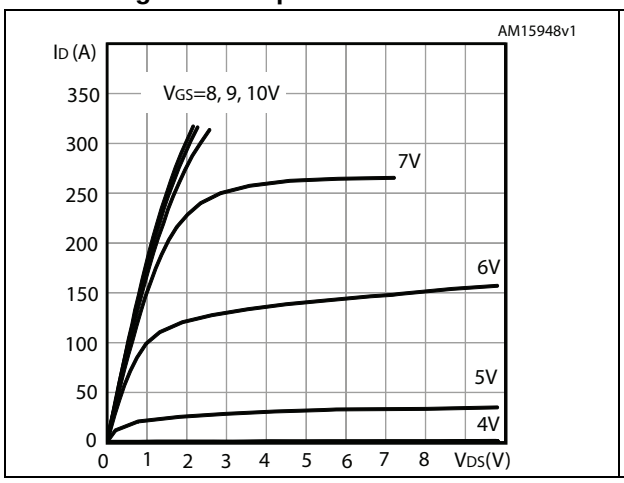


Figure 7. Transfer characteristics

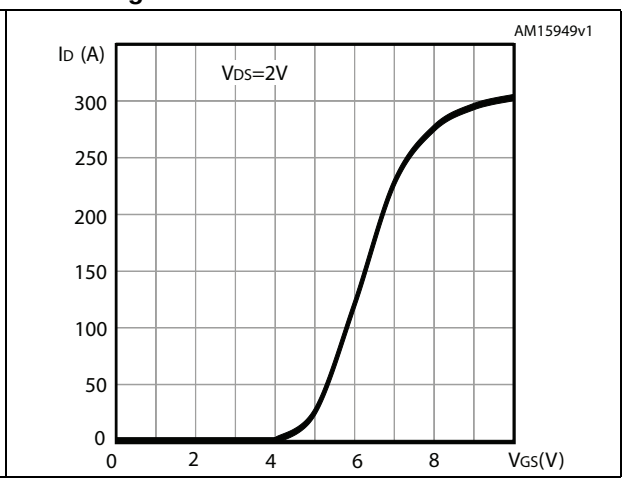


Figure 8. Gate charge vs gate-source voltage

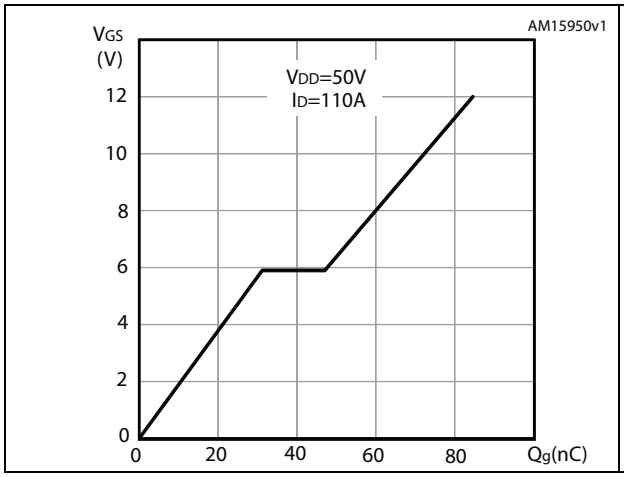


Figure 9. Static drain-source on-resistance for TO-220FP

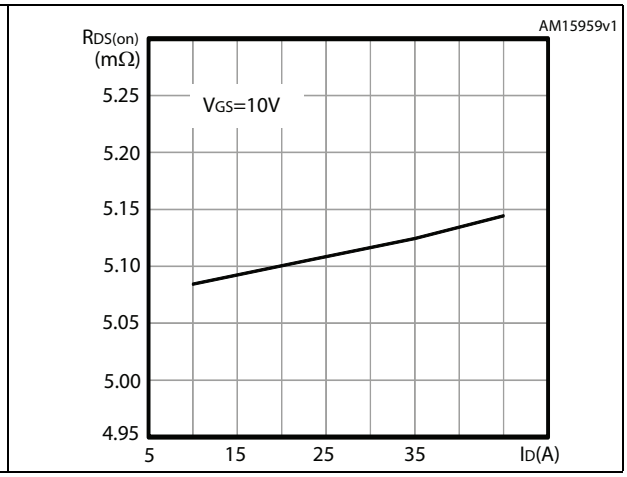


Figure 10. Static drain-source on-resistance for TO-220

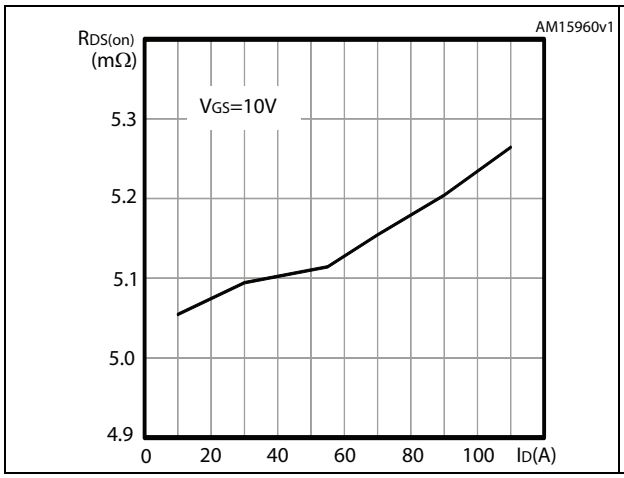


Figure 11. Capacitance variations

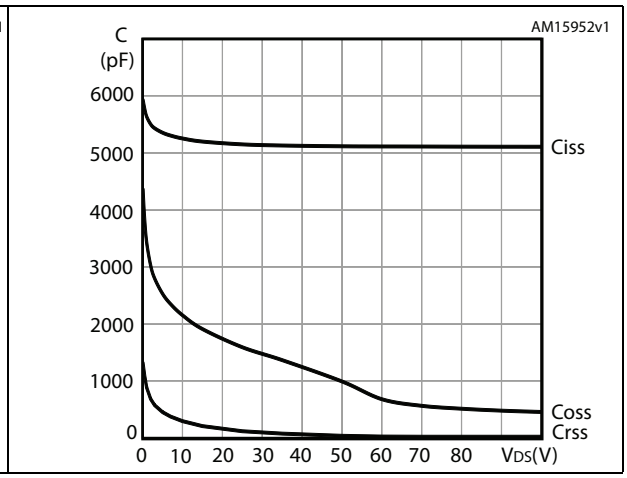


Figure 12. Normalized gate threshold voltage vs temperature

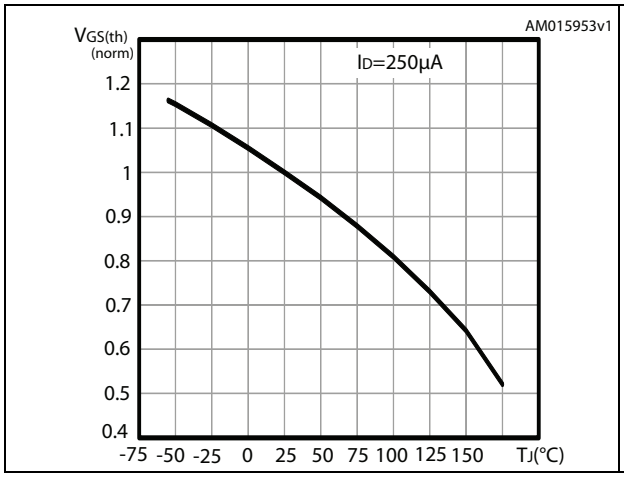


Figure 13. Normalized on-resistance vs temperature

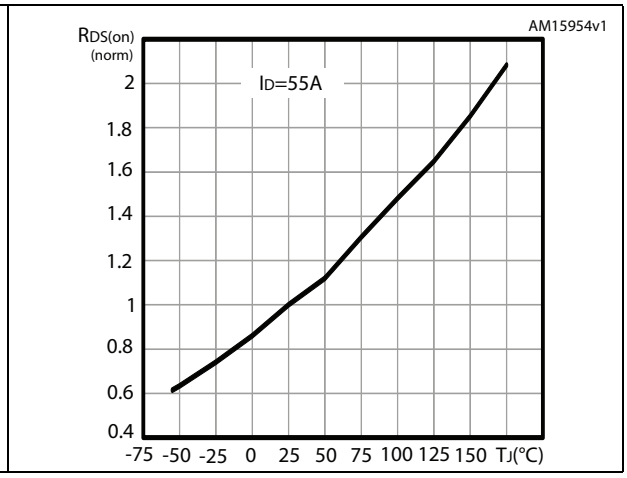


Figure 14. Normalized B_{VDSS} vs temperature

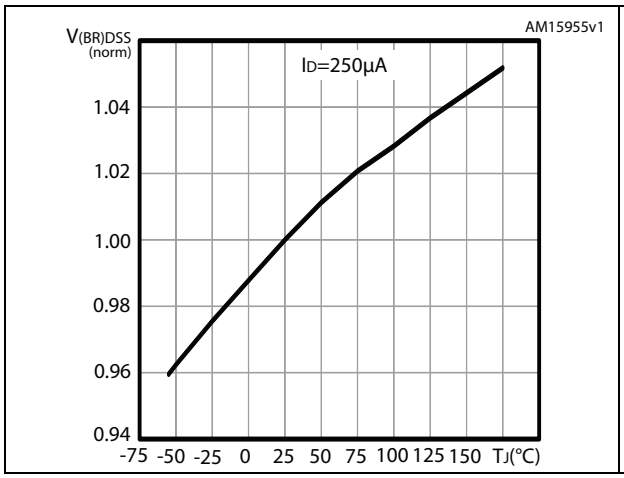
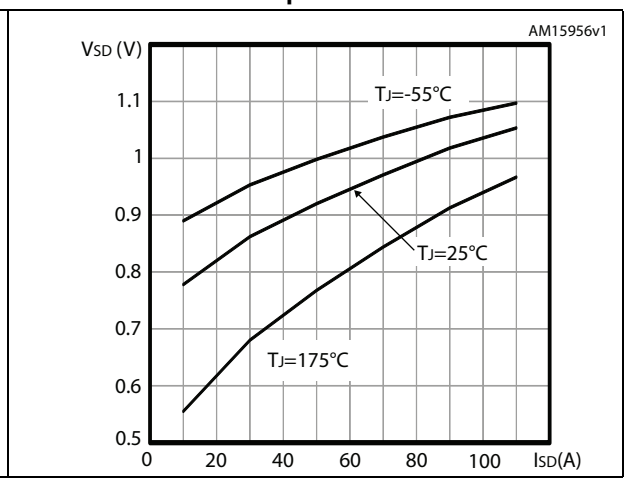


Figure 15. Source-drain diode forward vs temperature



3 Test circuits

Figure 16. Switching times test circuit for resistive load

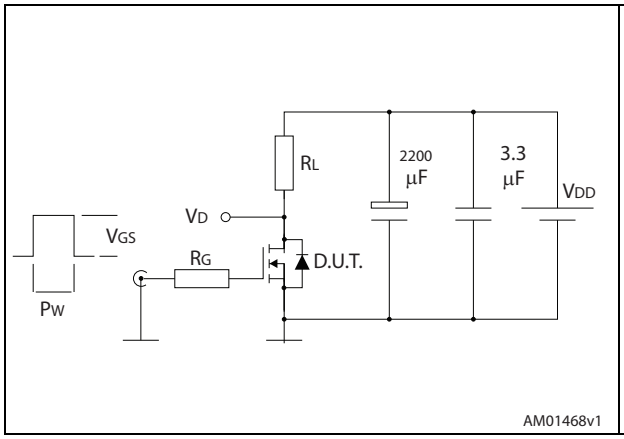


Figure 17. Gate charge test circuit

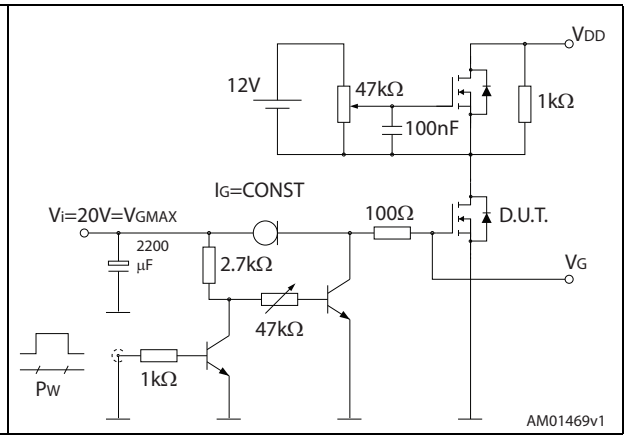


Figure 18. Test circuit for inductive load switching and diode recovery times

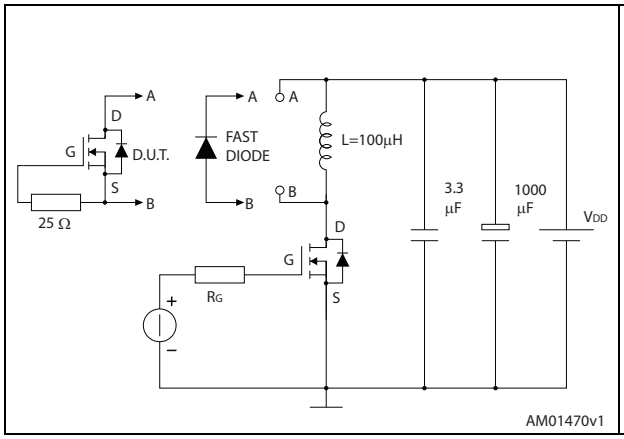


Figure 19. Unclamped inductive load test circuit

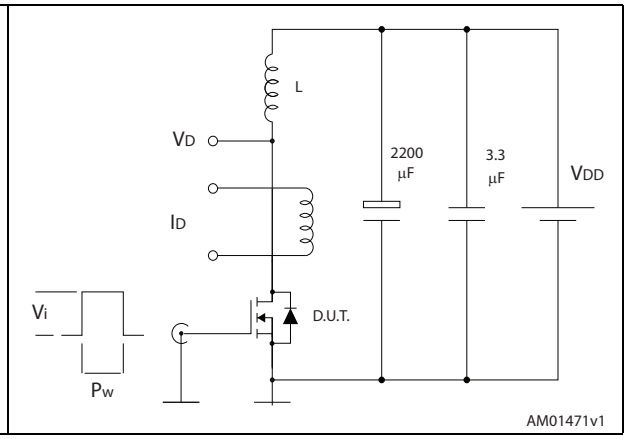


Figure 20. Unclamped inductive waveform

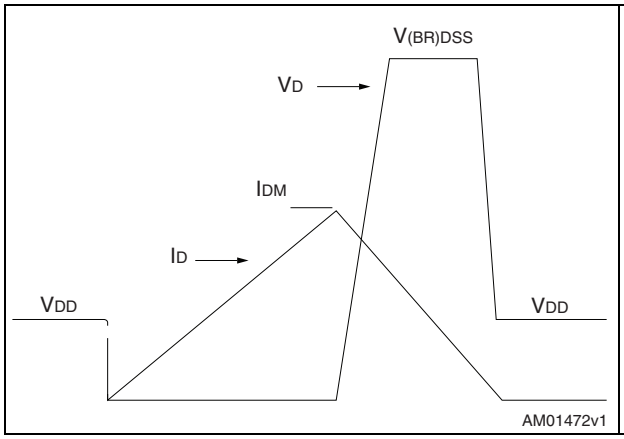
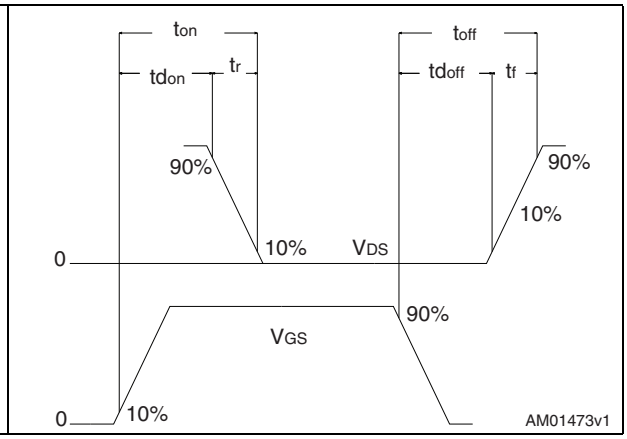


Figure 21. Switching time waveform



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

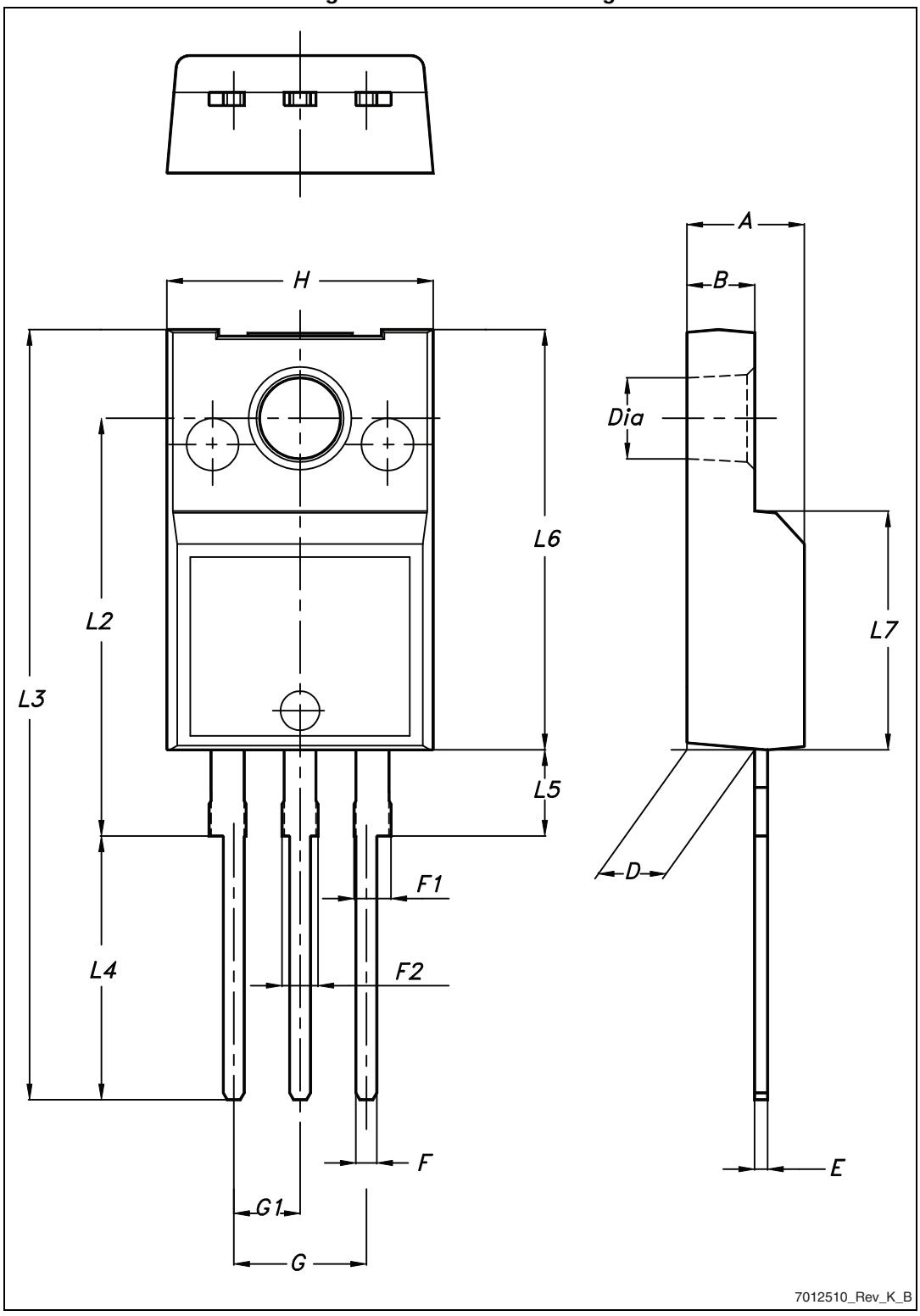
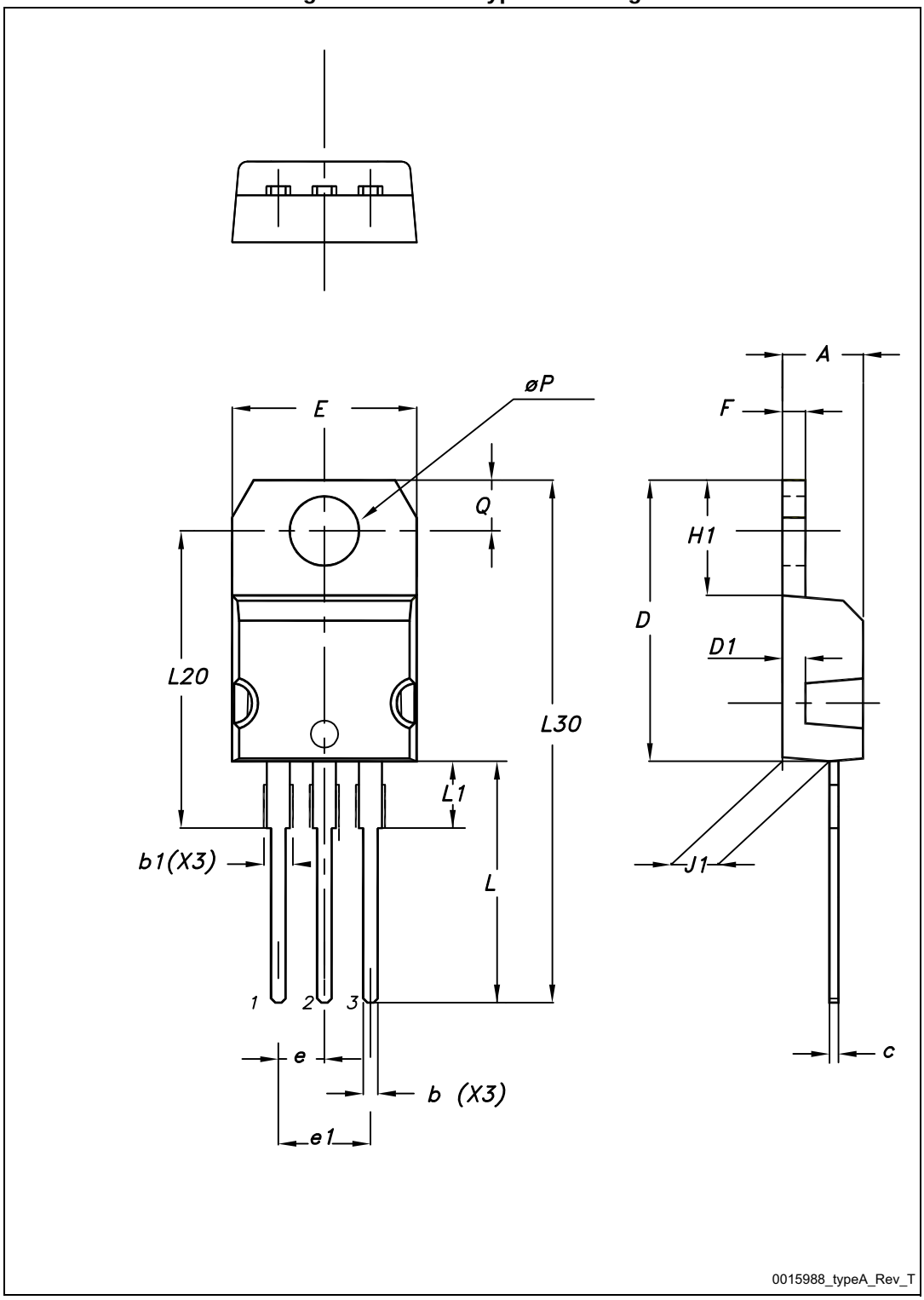


Table 9. TO-220 type A mechanical data

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	
∅P	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

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST’s terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST’S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

ST PRODUCTS ARE NOT AUTHORIZED FOR USE IN WEAPONS. NOR ARE ST PRODUCTS DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER’S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR “AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL” INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.
Information in this document supersedes and replaces all information previously supplied.
The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2013 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com