STB100N10F7, STD100N10F7, STF100N10F7, STP100N10F7

N-channel 100 V, 0.0068 Ω typ., 80 A, STripFET™ VII DeepGATE™ Power MOSFET in D²PAK, DPAK, TO-220FP and TO-220

Datasheet - production data

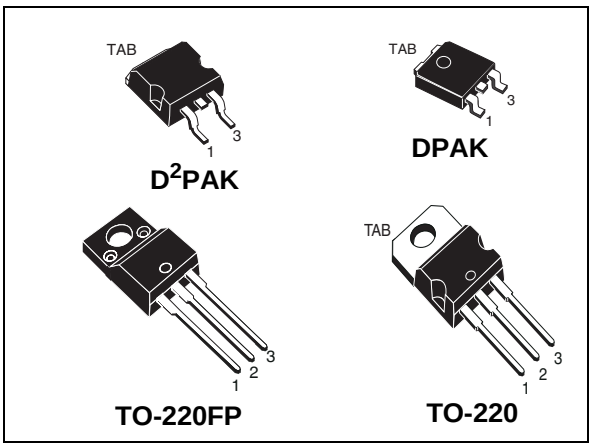
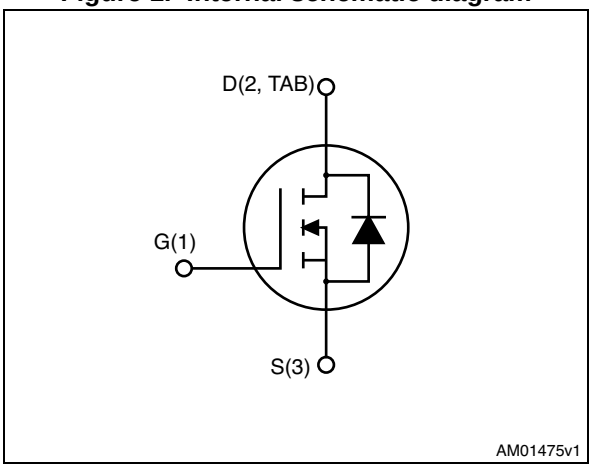


Figure 1. Internal schematic diagram



Features

Order codes	V_{DS}	$R_{DS(on)}$ max	I_D	P_{TOT}
STB100N10F7	100 V	0.008 Ω	80 A	120 W
STD100N10F7			80 A	120W
STF100N10F7			45 A	30 W
STP100N10F7			80A	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	Packages	Packaging
STB100N10F7	100N10F7	D²PAK	Tape and reel
STD100N10F7		DPAK	Tape and reel
STF100N10F7		TO-220FP	Tube
STP100N10F7		TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value			Unit
		DPAK	TO-220FP	TO-220 D^2PAK	
V_{DS}	Drain-source voltage	100			V
V_{GS}	Gate-source voltage	± 20			V
I_D	Drain current (continuous) at T_C = 25 °C	80	45(1)	80	A
I_D	Drain current (continuous) at T_C = 100 °C	62	32(1)	70	A
I_{DM}(2)	Drain current (pulsed)	320	180	320	A
P_{TOT} (1)	Total dissipation at T_C = 25 °C	120	30	150	W
T_J	Operating junction temperature	-55 to 175			°C
T_{stg}	Storage temperature				°C

1. This value is limited by package.
2. Pulse width limited by safe operating area.

Table 3. Thermal resistance

Symbol	Parameter	Value				Unit
		D^2PAK	DPAK	TO-220FP	TO-220	
$R_{thj\text{-}case}$	Thermal resistance junction-case	1	1.25	5	1	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient			62.50		°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb	30	50			°C/W

1. When mounted on FR-4 board of 1inch², 2oz Cu, t < 10 sec

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
E_{AS}	Single pulse avalanche energy (T_J = 25 °C, L = 3.5 mH, I_{AS} = 15 A, V_{DD} = 50 V, V_{GS} = 10 V)	400	mJ

2 Electrical characteristics

(T_{CASE}=25 °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 µA	100		-	V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 100 V V_{DS} = 100 V; T_C=125 °C			1 100	µA 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 D^2PAK, DPAK and TO-220 V_{GS}= 10 V, I_D= 40 A For TO-220-FP V_{GS}= 10 V, I_D= 22.5 A		0.0068	0.008	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} =50 V, f=1 MHz, V_{GS}=0	-	4369	-	pF
C_{oss}	Output capacitance		-	823	-	pF
C_{rss}	Reverse transfer capacitance		-	36	-	pF
Q_g	Total gate charge	V_{DD}=50 V, I_D = 80 A V_{GS} =10 V *Figure 18*	-	61	-	nC
Q_{gs}	Gate-source charge		-	26	-	nC
Q_{gd}	Gate-drain charge		-	13	-	nC

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD}=50 V, I_D= 40 A, R_G=4.7 Ω, V_{GS}= 10 V *Figure 17*	-	27	-	ns
t_r	Rise time		-	40	-	ns
$t_{d(off)}$	Turn-off delay time		-	46	-	ns
t_f	Fall time		-	15	-	ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current		-		80	A
I_{SDM}(1)	Source-drain current (pulsed)		-		320	A
V_{SD}(2)	Forward on voltage	I_{SD} = 80 A, V_{GS}=0	-		1.2	V
t_{rr}	Reverse recovery time	I_{SD} = 80 A, di/dt = 100 A/µs, V_{DD}=80 V, T_j=150 °C	-	77		ns
Q_{rr}	Reverse recovery charge		-	146		nC
I_{RRM}	Reverse recovery current		-	4		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 DPAK

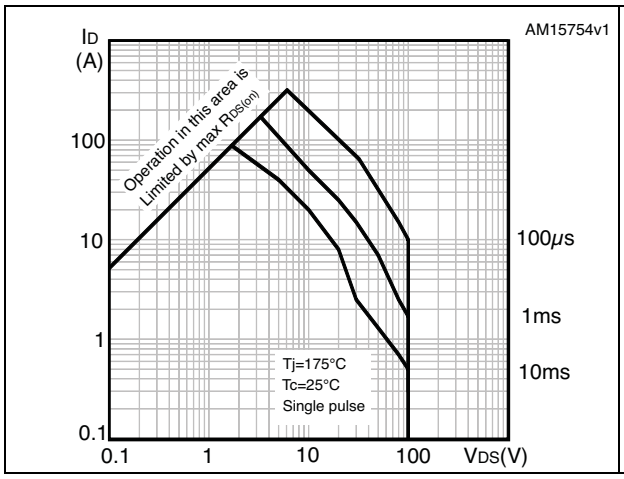


Figure 3. Thermal impedance for DPAK

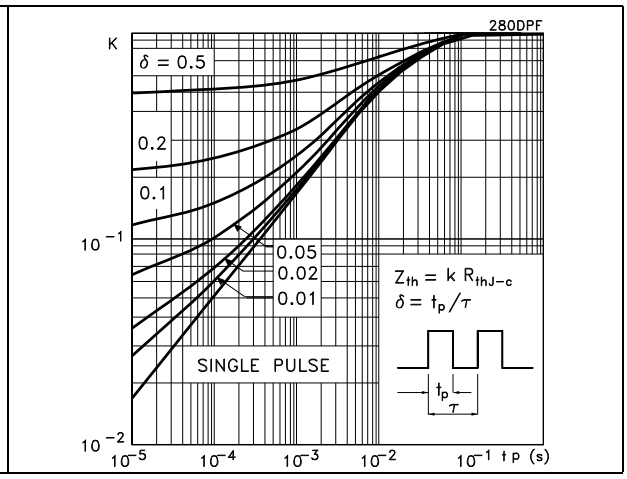


Figure 4. Safe operating area for TO-220FP

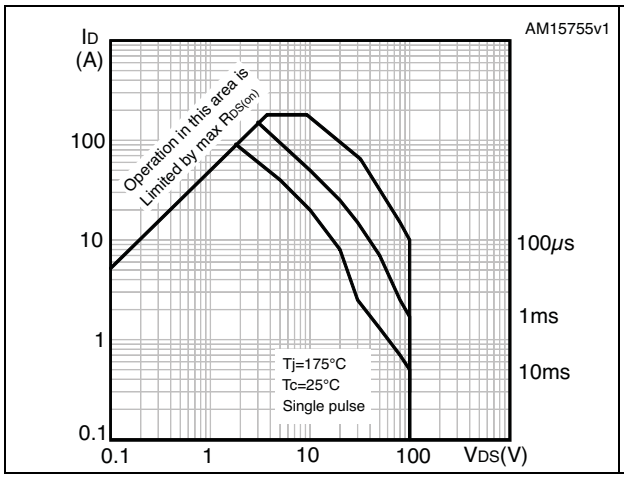


Figure 5. Thermal impedance for TO-220FP

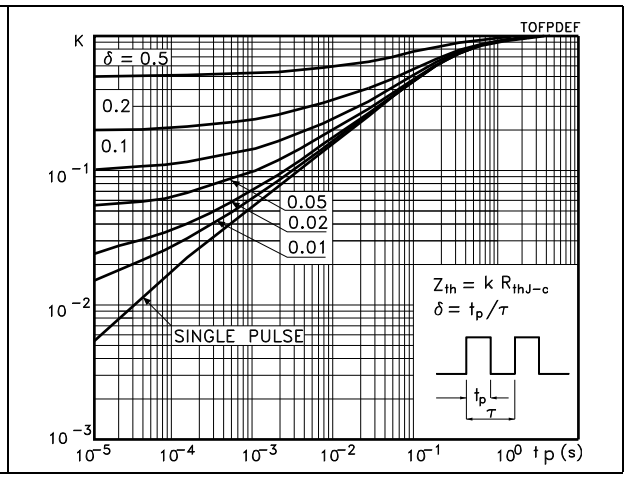


Figure 6. Safe operating area for D²PAK and TO-220

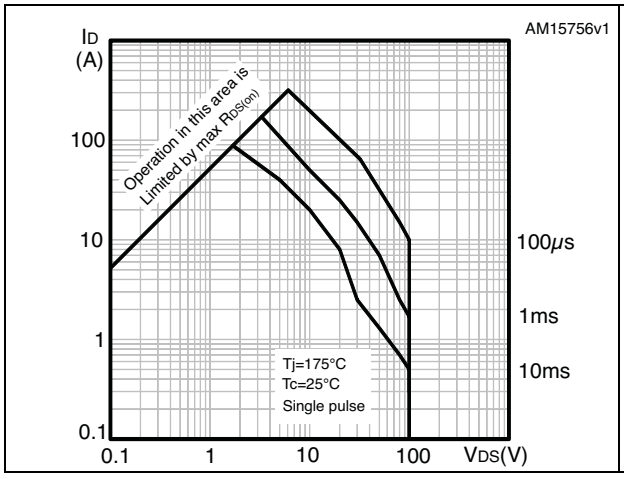


Figure 7. Thermal impedance for D²PAK and TO-220

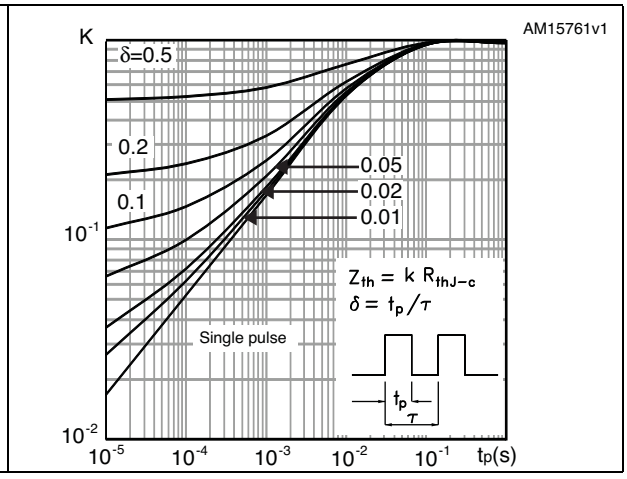


Figure 8. Output characteristics

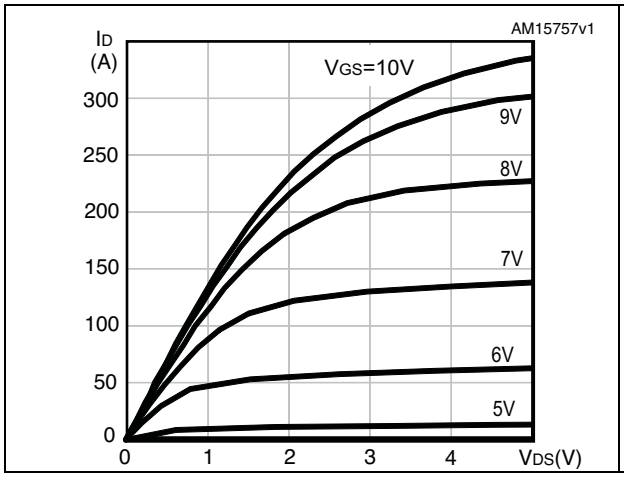


Figure 9. Transfer characteristics

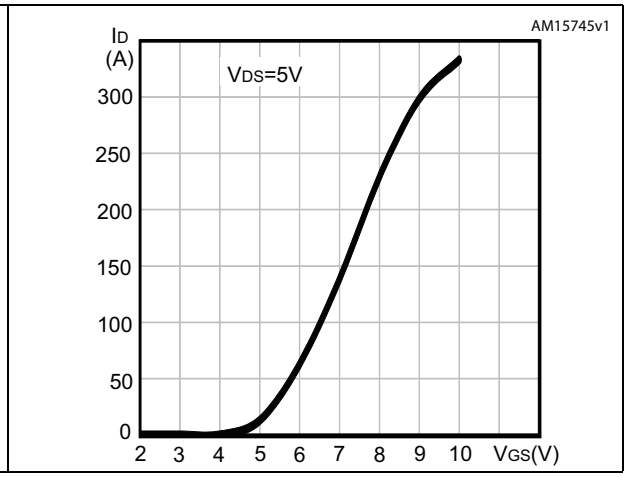


Figure 10. Normalized $V_{(BR)DSS}$ vs temperature

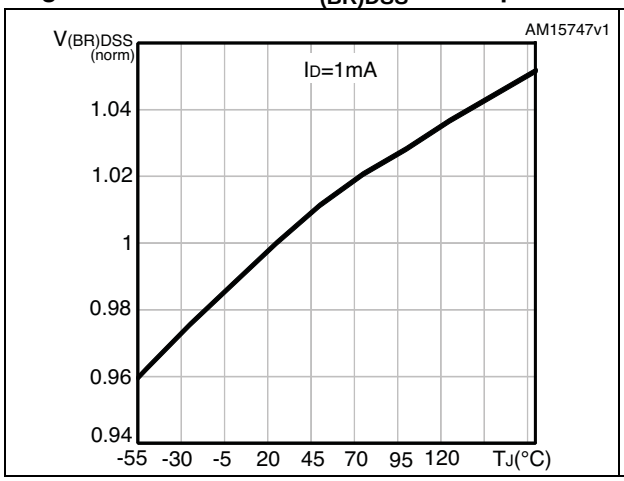


Figure 11. Static drain-source on-resistance

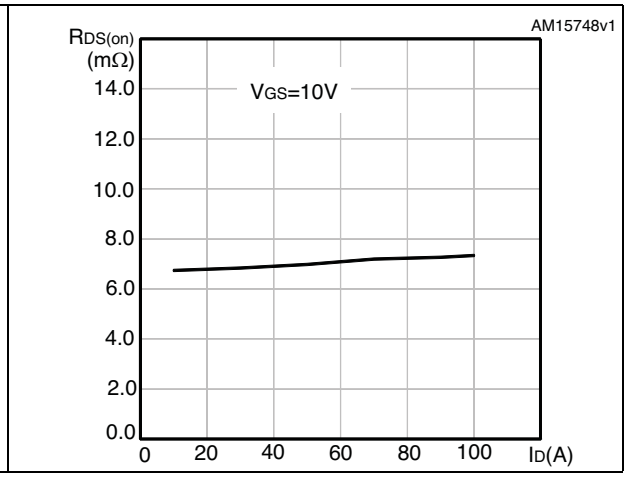


Figure 12. Gate charge vs gate-source voltage

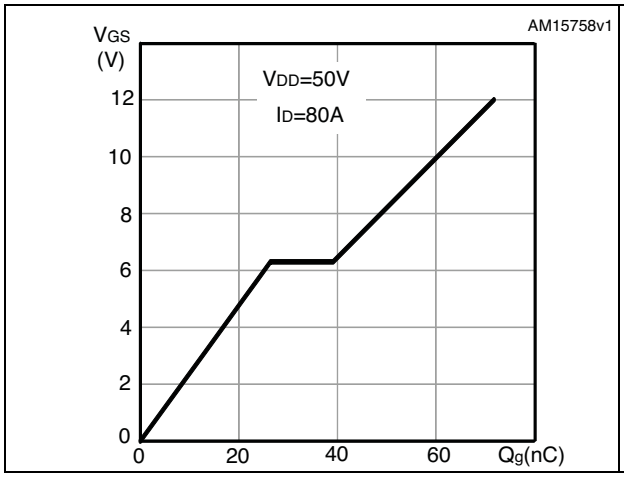


Figure 13. Capacitance variations

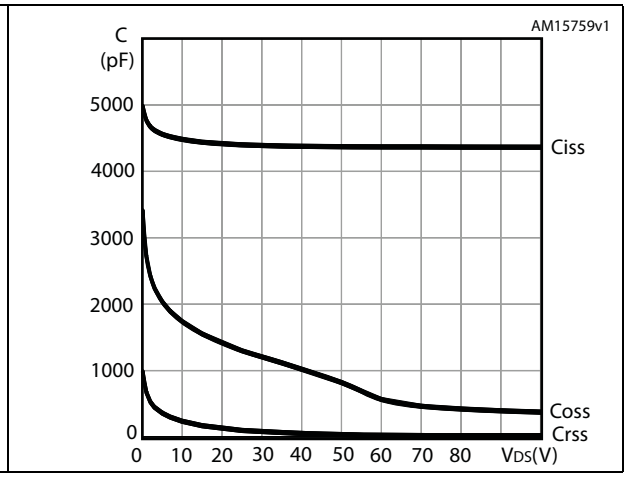


Figure 14. Normalized gate threshold voltage vs temperature

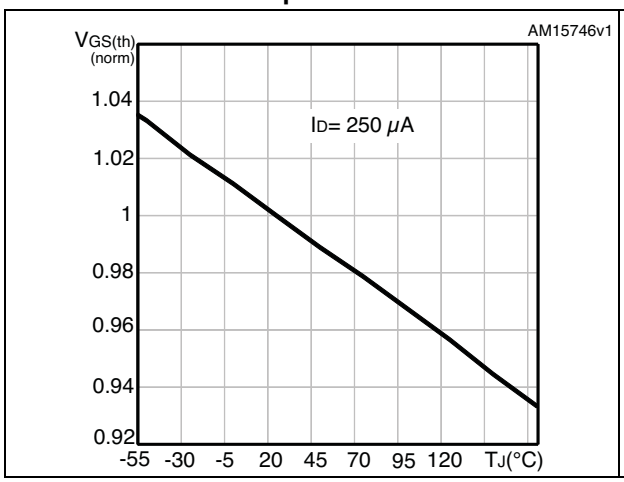


Figure 15. Normalized on-resistance vs temperature

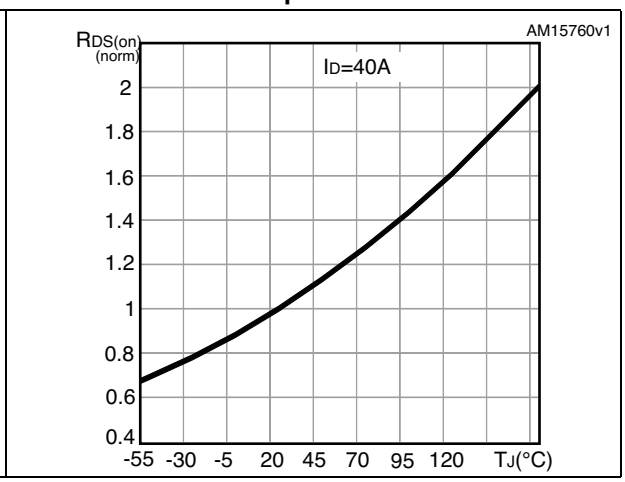
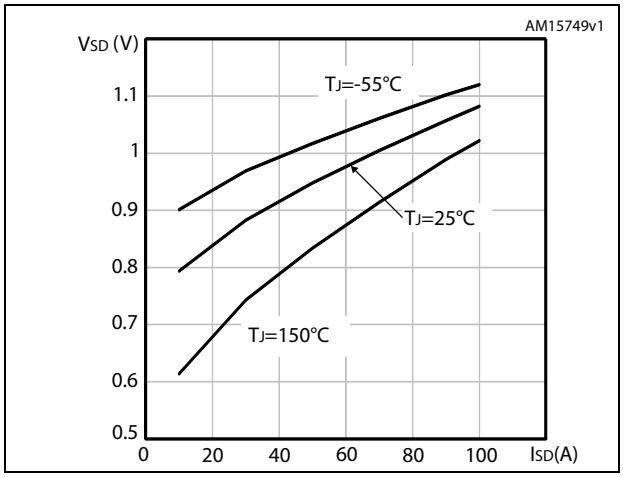


Figure 16. Source-drain diode forward characteristics



3 Test circuits

Figure 17. Switching times test circuit for resistive load

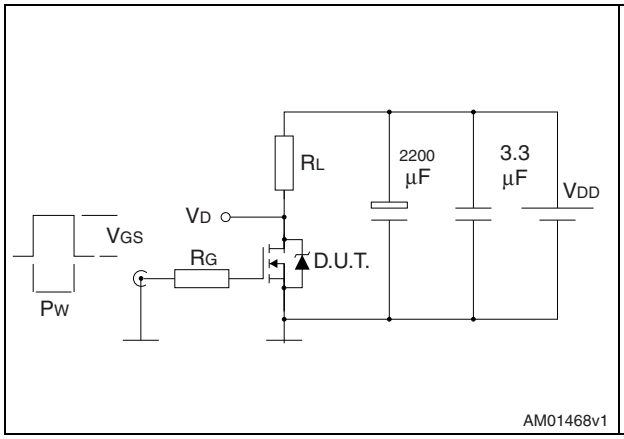


Figure 18. Gate charge test circuit

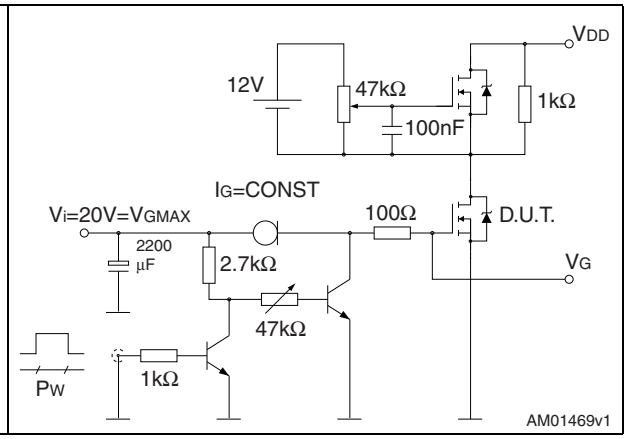


Figure 19. Test circuit for inductive load switching and diode recovery times

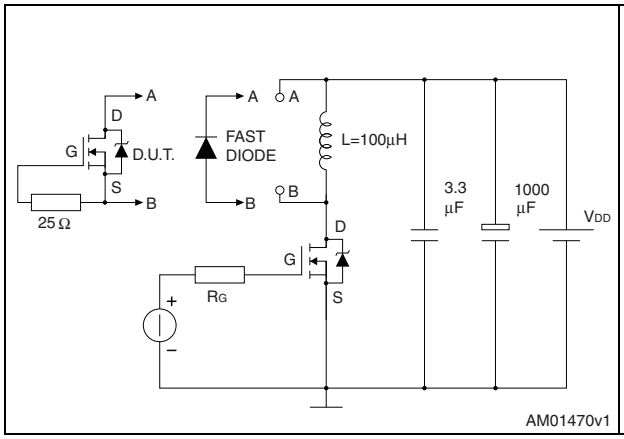


Figure 20. Unclamped inductive load test circuit

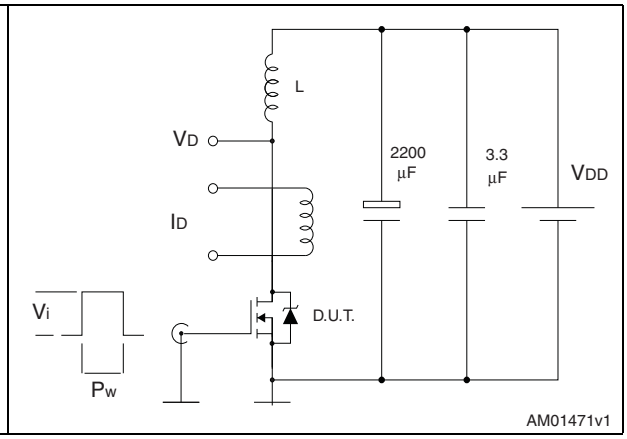


Figure 21. Unclamped inductive waveform

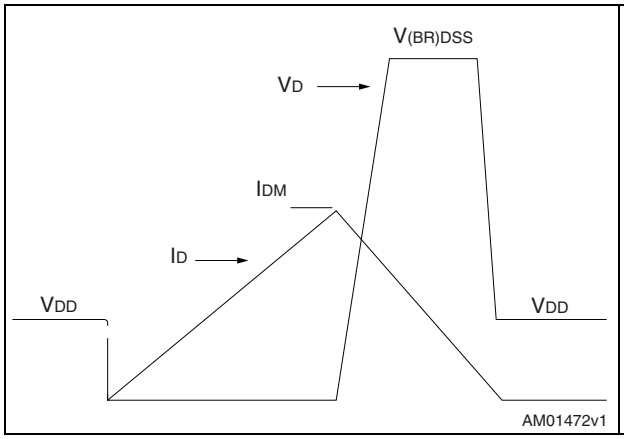
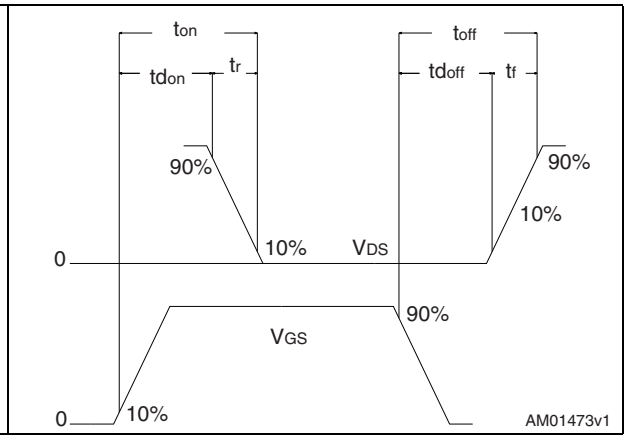


Figure 22. Switching time waveform



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.

Figure 23. D²PAK (TO-263) drawing

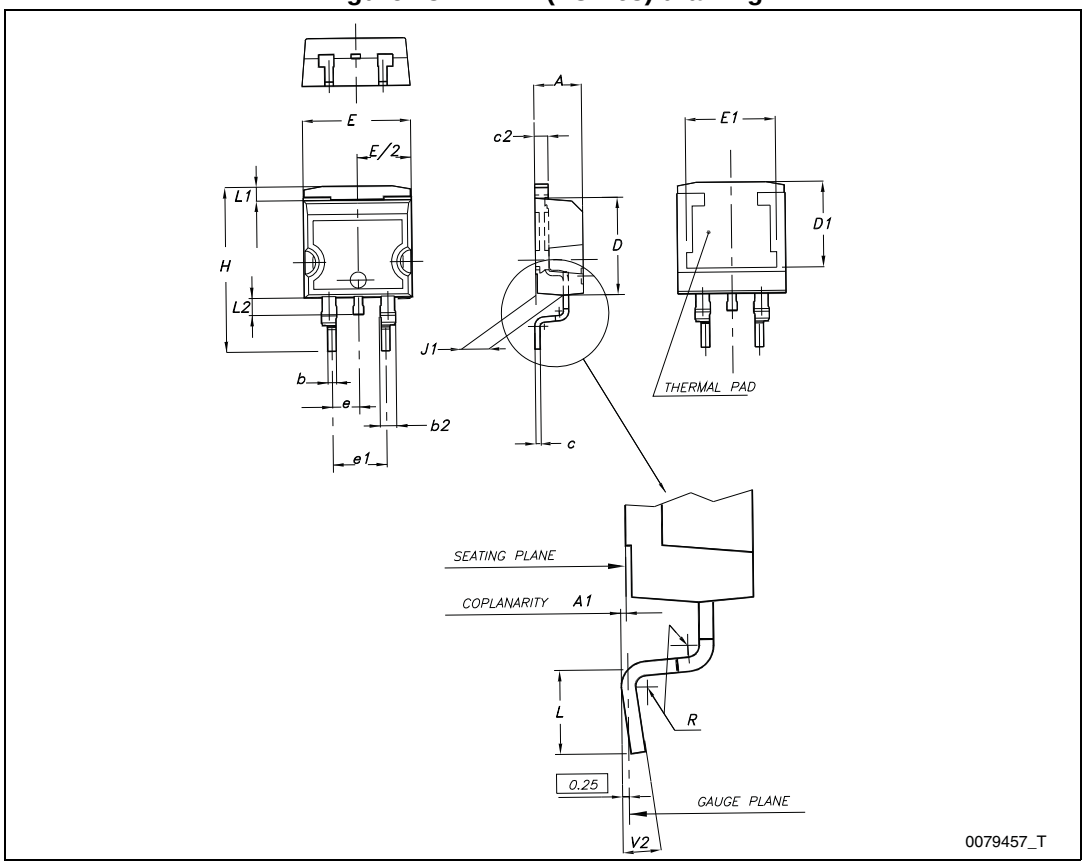
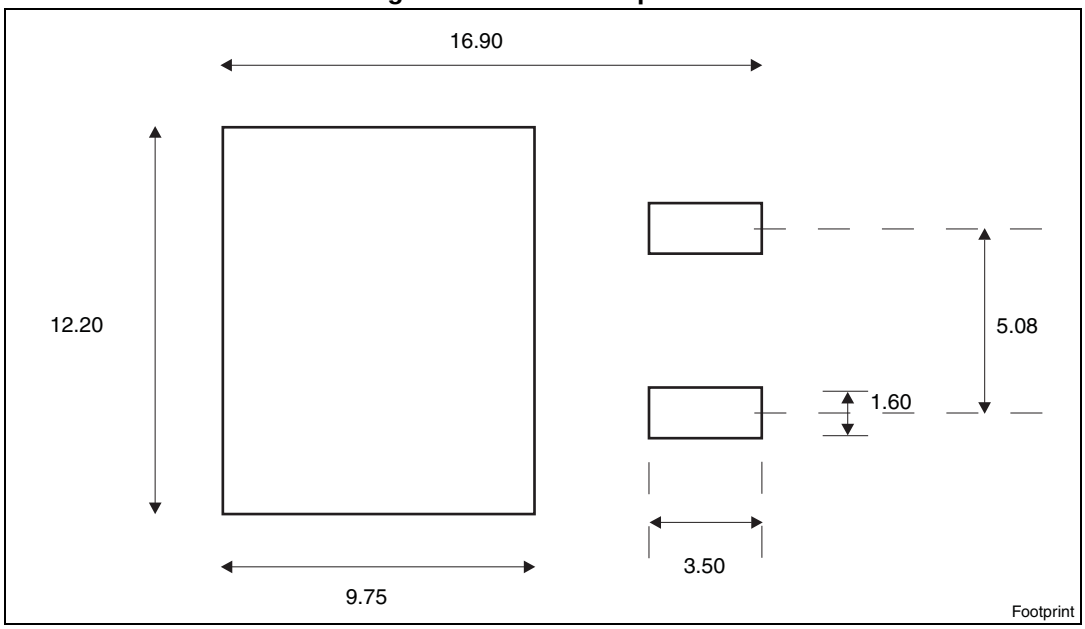


Figure 24. D²PAK footprint[(a)]



a. All dimension are in millimeters

Table 9. DPAK (TO-252) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
(L1)		2.80	
L2		0.80	
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 25. DPAK (TO-252) drawing

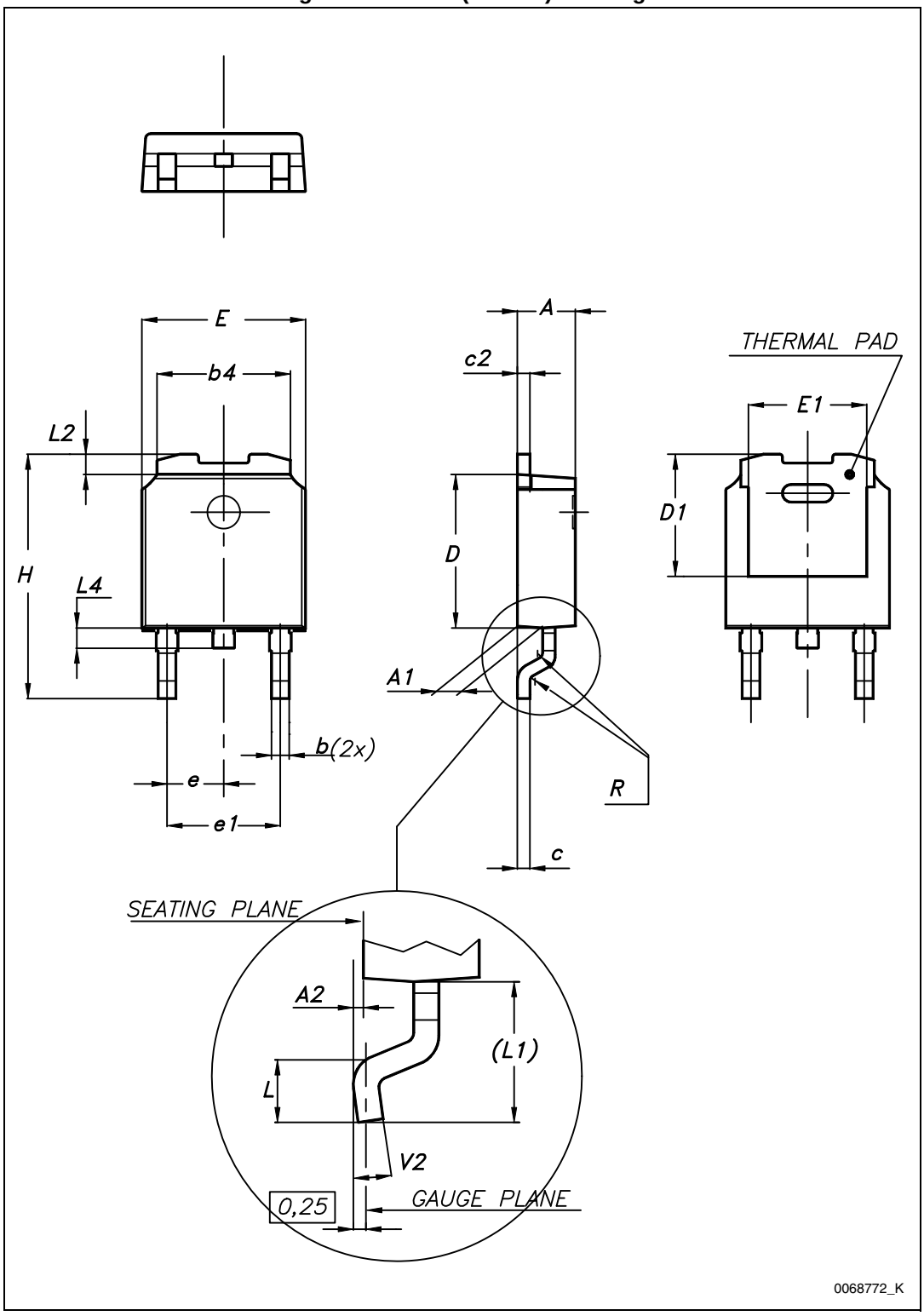
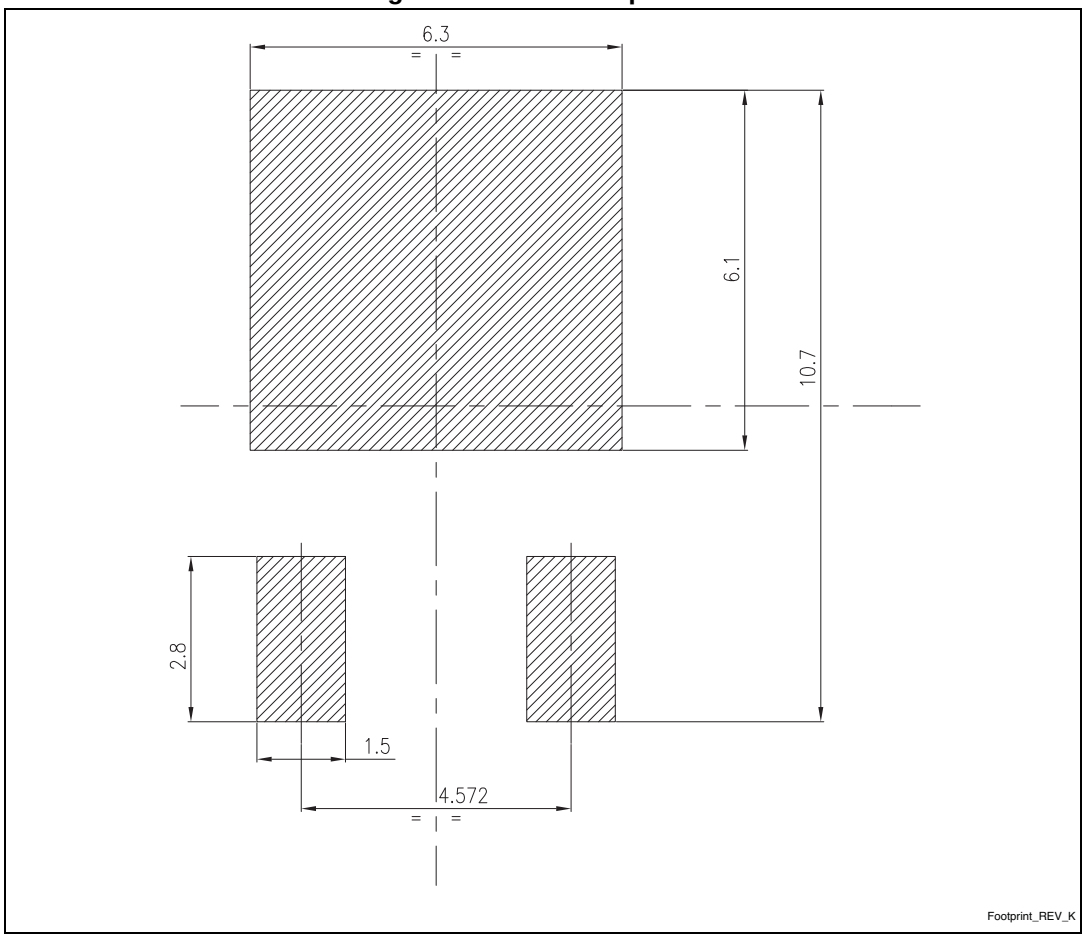


Figure 26. DPAK footprint [(b)]



b. All dimensions are in millimeters

Table 10. 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 27. TO-220FP drawing

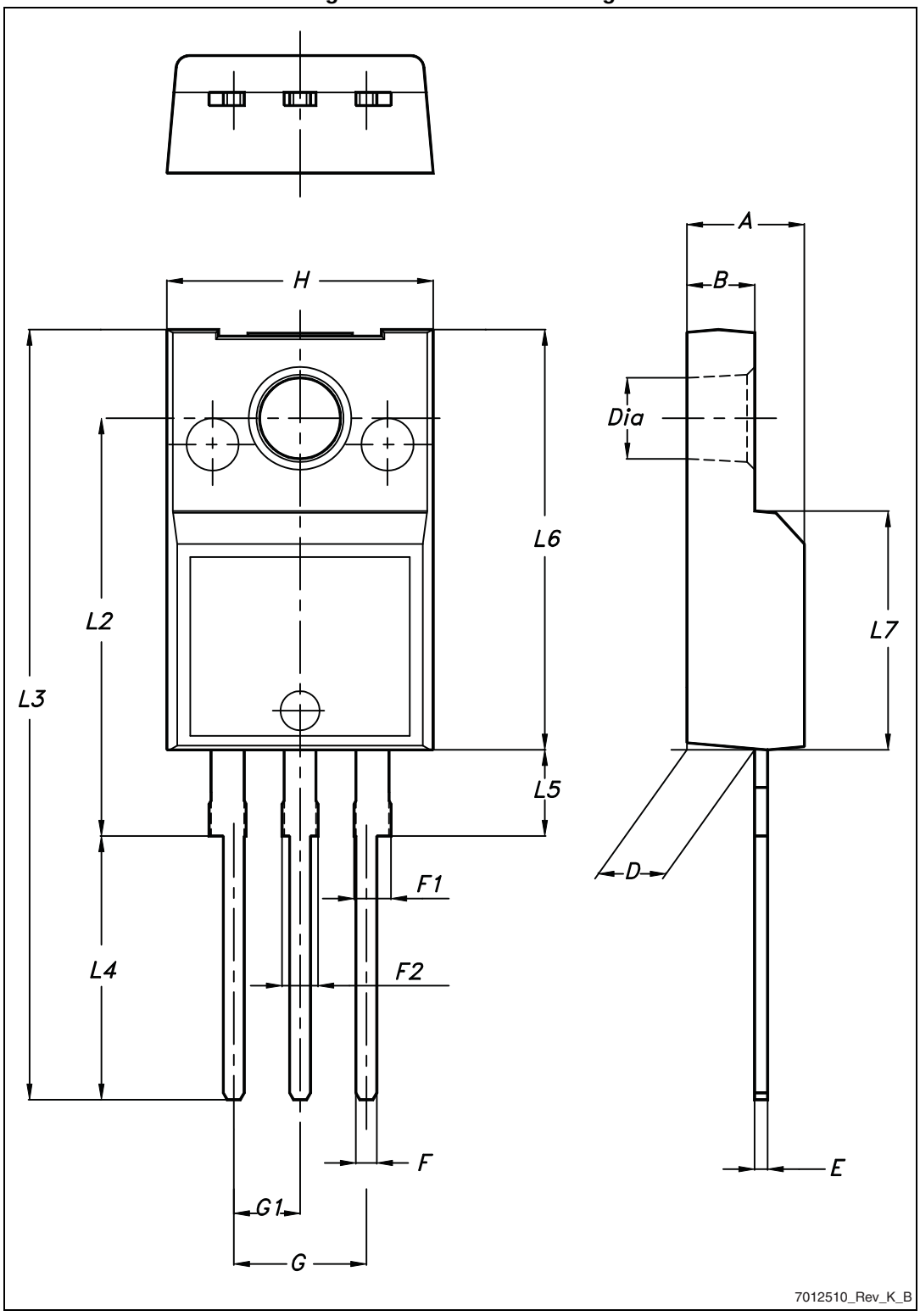
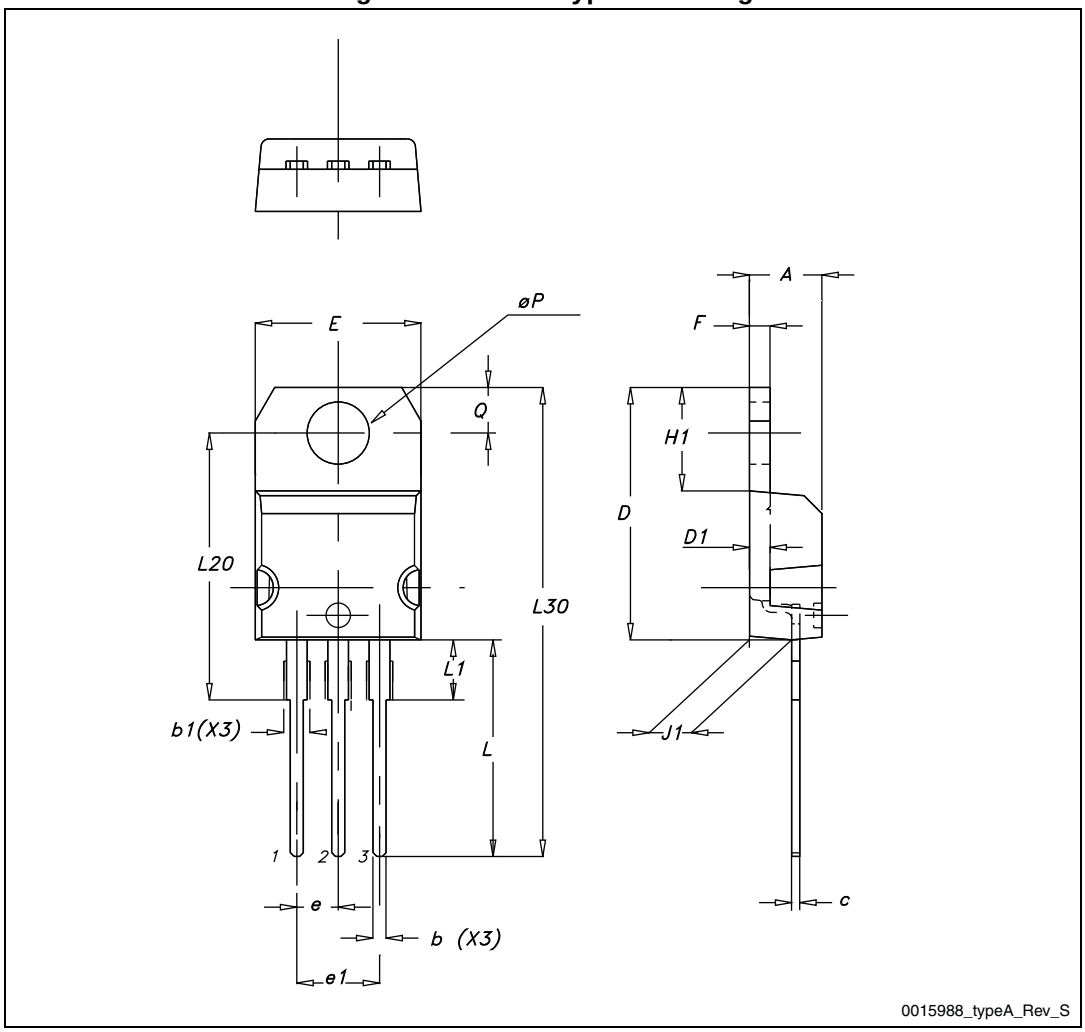


Table 11. TO-220 type A mechanical data

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 28. TO-220 type A drawing



5 Packaging mechanical data

Table 12. D²PAK (TO-263) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Table 13. DPAK (TO-252) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500

Table 13. DPAK (TO-252) tape and reel mechanical data (continued)

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

Figure 29. Tape

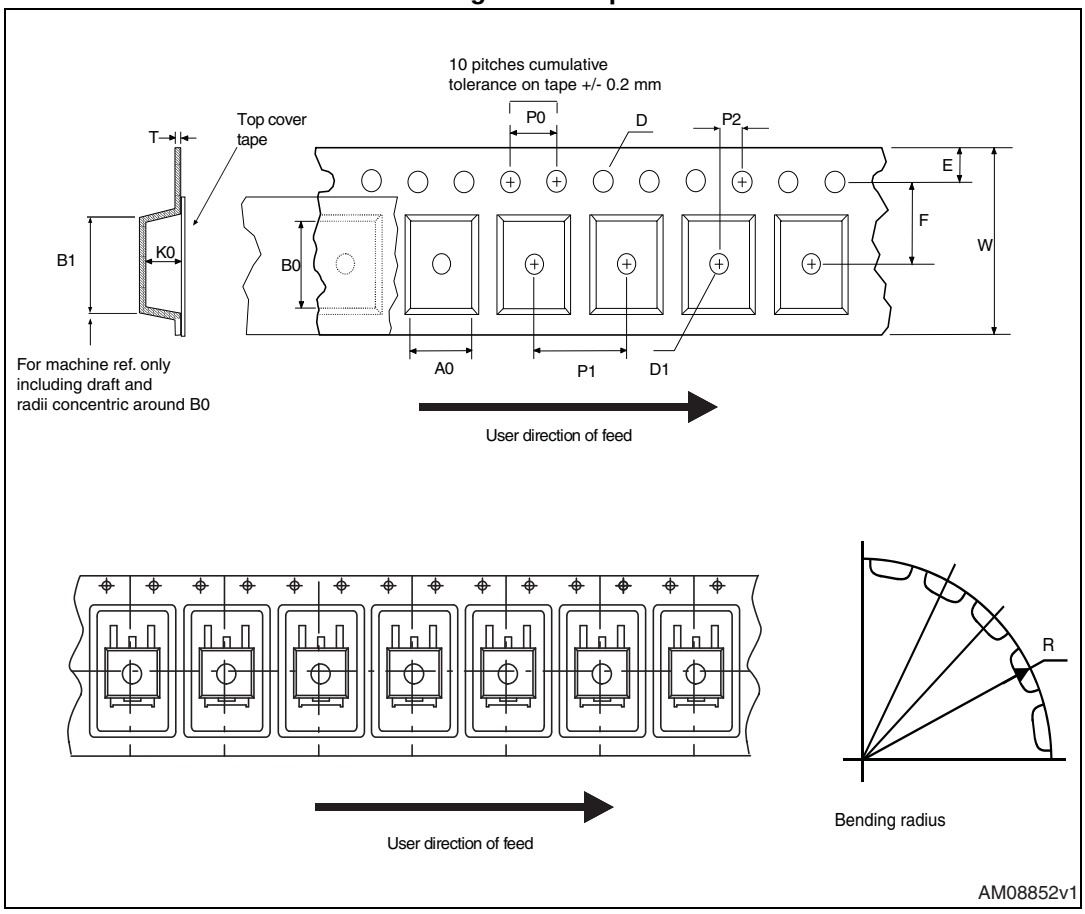
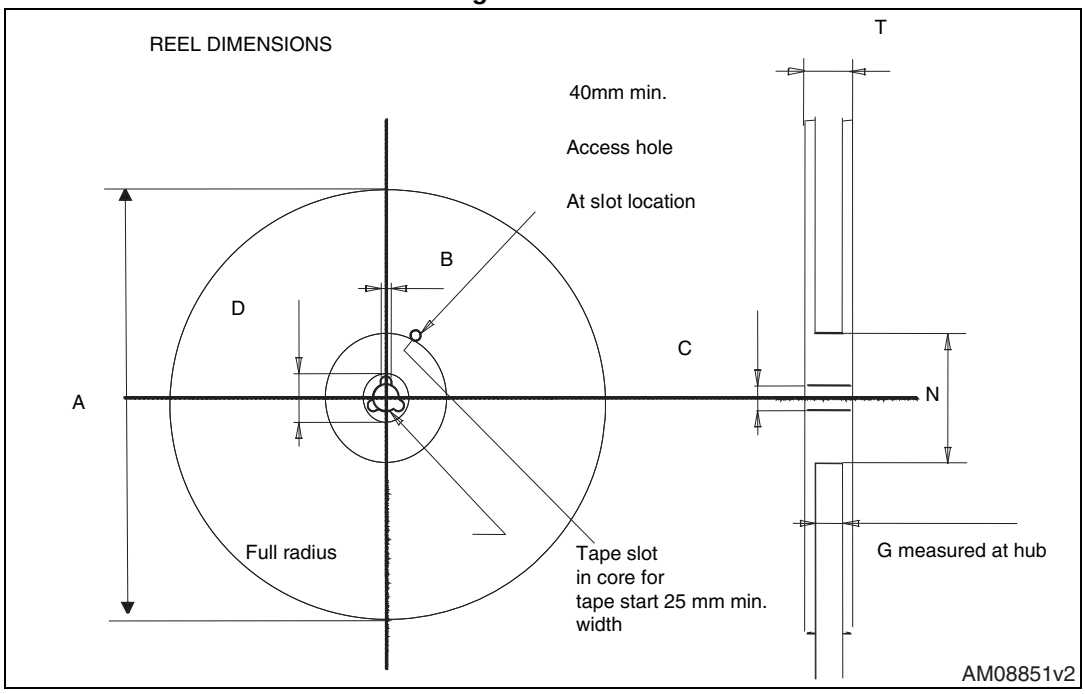


Figure 30. Reel



6 Revision history

Table 14. Document revision history

Date	Revision	Changes
05-Oct-2012	1	First release.
07-Feb-2013	2	– Inserted device in TO-220FP. – Updated title and features on the cover page, *Table 1: Device summary*, *Table 2: Absolute maximum ratings*, *Table 3: Thermal resistance* and *Table 5: On/off states* accordingly. – Updated *Table 6: Dynamic*, *Table 7: Switching times*, *Table 8: Source drain diode* and *Section 4: Package mechanical data*. – Added *Section 5: Packaging mechanical data*.
29-Apr-2013	3	– Modified: the entire typical values in *Table 6*, t_f typical value in*Table 7*, V_{SD} and typical values for t_{rr}, q_{rr}, I_{RRM} – Inserted:*Table 4: Avalanche characteristics* and *Section 2.1: Electrical characteristics (curves)* – Minor text changes
25-Nov-2013	4	– Inserted device in D^2PAK. – Updated title and features on the cover page, *Table 1: Device summary*, *Table 2: Absolute maximum ratings*, *Table 3: Thermal resistance* and *Table 5: On/off states* accordingly. – Updated *Table 6: Dynamic*, *Section 4: Package mechanical data* and *Section 5: Packaging mechanical data*.