

N-channel 100 V, 0.0068  $\Omega$  typ., 80 A, STripFET™ VII DeepGATE™  
Power MOSFET in DPAK, TO-220FP and TO-220 packages

Datasheet - production data

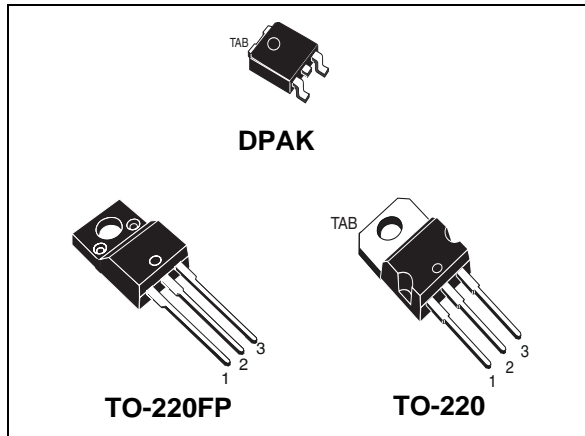
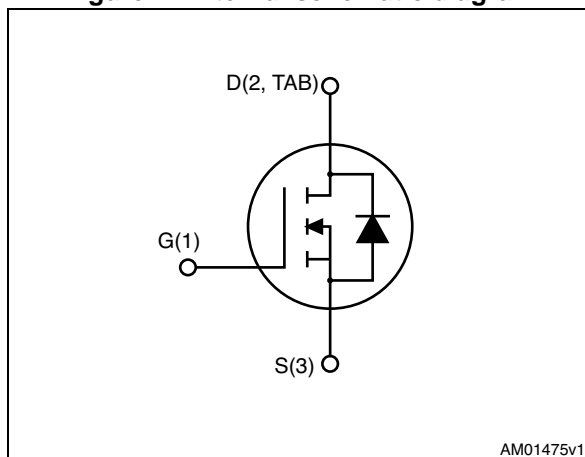


Figure 1. Internal schematic diagram



## Features

Order codes	$V_{DSS}$	$R_{DS(on)}$	$I_D$	$P_{TOT}$
STD100N10F7	100 V	0.008 $\Omega$	80 A	120 W
STF100N10F7			45 A	30 W
STP100N10F7			80A	150 W

- Ultra low on-resistance
- 100% avalanche tested

## Applications

- Switching applications

## Description

These devices utilize the 7<sup>th</sup> 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
STD100N10F7	100N10F7	DPAK	Tape and reel
STF100N10F7		TO-220FP	Tube
STP100N10F7		TO-220	Tube

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value			Unit
		DPAK	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 $T_C = 25\text{ °C}$	80	45	80	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ °C}$	62	32	70	A
$I_{DM}^{(2)}$	Drain current (pulsed)	320	180	320	A
$P_{TOT}^{(1)}$	Total dissipation at $T_{pcb} = 25\text{ °C}$	120	30	150	W
$T_J$	Operating junction temperature	-55 to 175			°C
$T_{stg}$	Storage temperature				°C

1. This value is rated according to  $R_{thj-c}$  and limited by package.
2. Pulse width limited by safe operating area.

**Table 3. Thermal resistance**

Symbol	Parameter	Value			Unit
		DPAK	TO-220FP	TO-220	
$R_{thj-case}$	Thermal resistance junction-case	1.25	5	1.00	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	62.50			°C/W
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	50			°C/W

1. When mounted on FR-4 board of 1inch<sup>2</sup>, 2oz Cu,  $t < 10\text{ sec}$

**Table 4. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$E_{AS}$	Single pulse avalanche energy ( $T_J = 25\text{ °C}$ , $L = 3.5\text{ mH}$ , $I_{AS} = 15\text{ A}$ , $V_{DD} = 50\text{ V}$ , $V_{GS} = 10\text{ V}$ )	400	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 ( $V_{GS}=0$ )	$I_D = 250\ \mu A$	100		-	V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS}=0$ )	$V_{DS} = 100\text{ V}$ $V_{DS} = 100\text{ V}; T_C=125\text{ °C}$			1 100	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS}=0$ )	$V_{GS} = 20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu A$	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	For DPAK and TO-220 $V_{GS} = 10\text{ V}, I_D = 40\text{ A}$ For TO-220-FP $V_{GS} = 10\text{ V}, I_D = 22.5\text{ A}$		0.0068	0.008	$\Omega$

**Table 6. Dynamic**

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

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 50\text{ V}, I_D = 40\text{ A},$ $R_G = 4.7\ \Omega, V_{GS} = 10\text{ V}$ <a href="#">Figure 17</a>	-	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	$I_{SD} = 80 \text{ A}$ , $V_{GS}=0$	-		1.2	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 80 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD}=80 \text{ V}$ , $T_j=150 \text{ }^\circ\text{C}$	-	77		ns
$Q_{rr}$	Reverse recovery charge		-	146		nC
$I_{RRM}$	Reverse recovery current		-	4		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 for DPAK

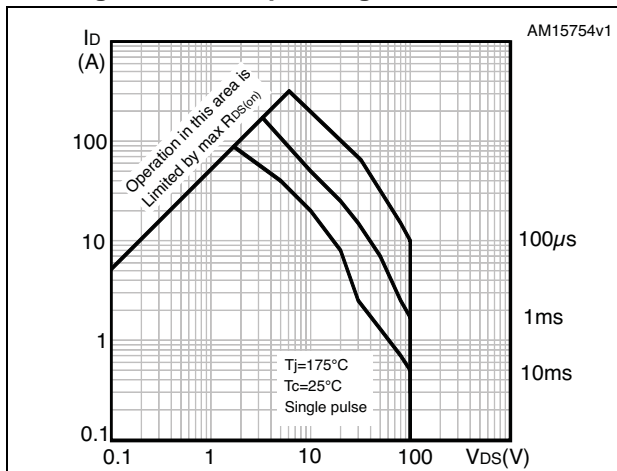


Figure 3. Thermal impedance for DPAK

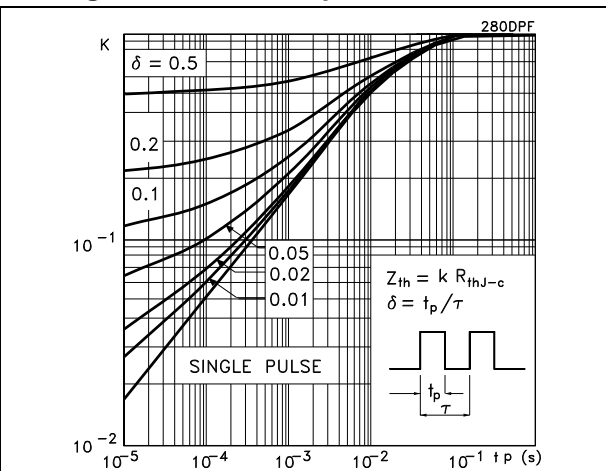


Figure 4. Safe operating area for TO-220FP

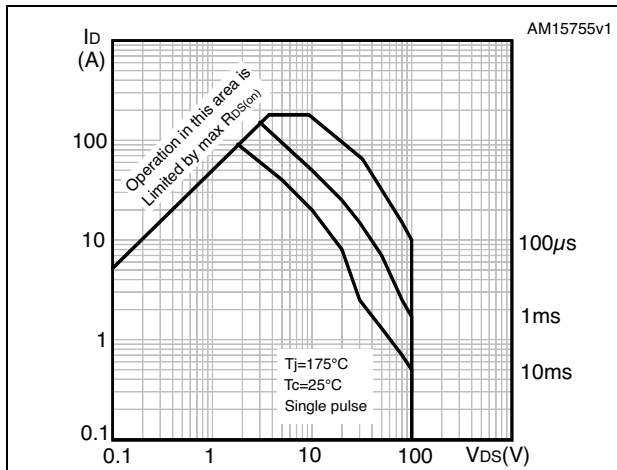


Figure 5. Thermal impedance for TO-220FP

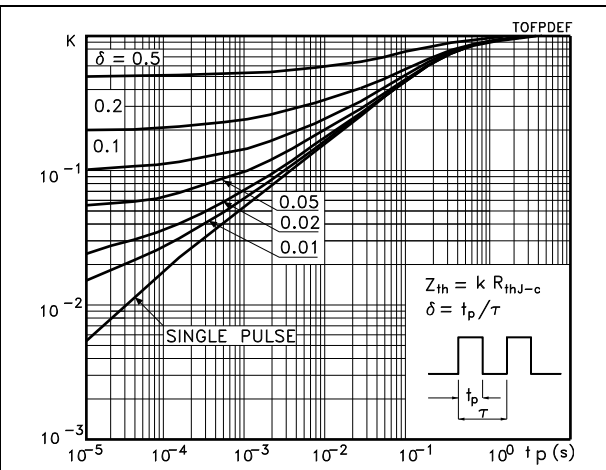


Figure 6. Safe operating area for TO-220

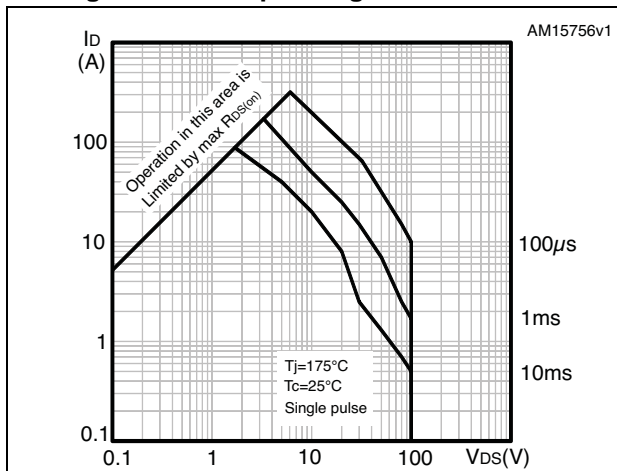


Figure 7. Thermal impedance for TO-220

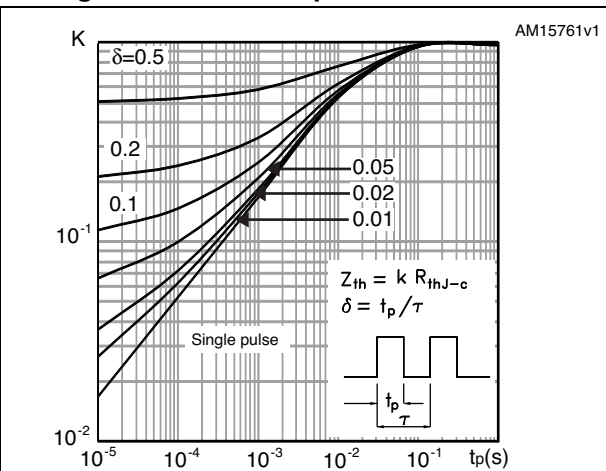


Figure 8. Output characteristics

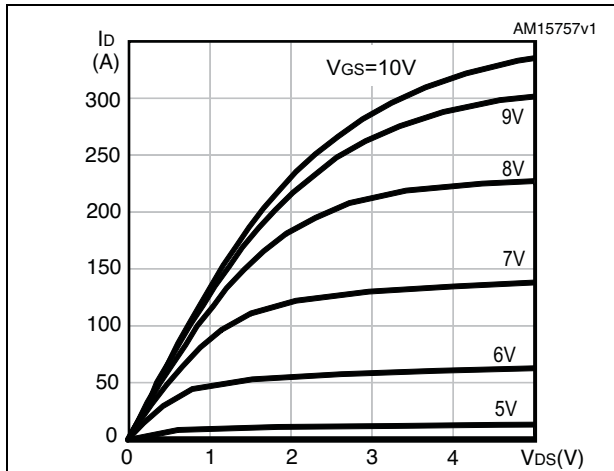


Figure 9. Transfer characteristics

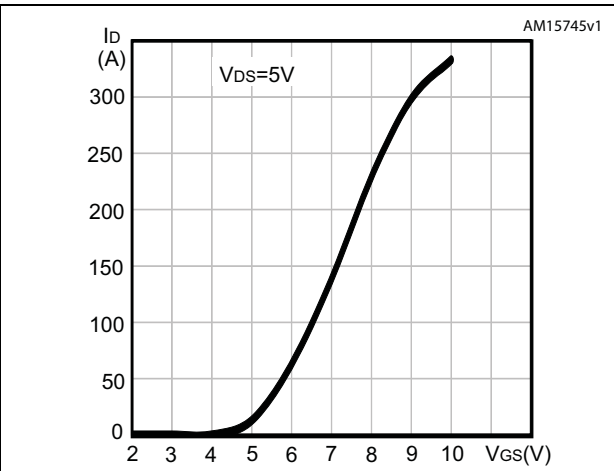


Figure 10. Normalized  $V_{(BR)DSS}$  vs temperature

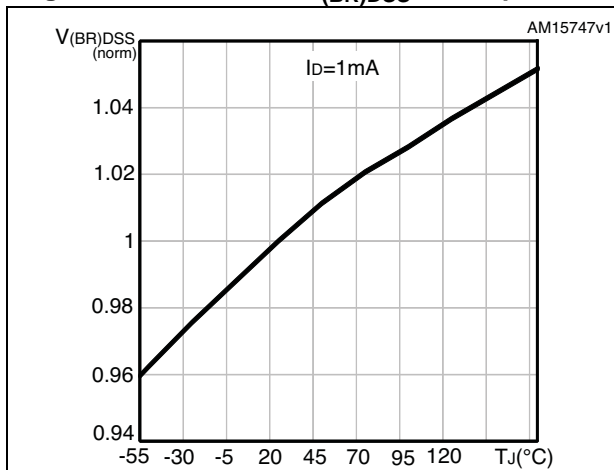


Figure 11. Static drain-source on-resistance

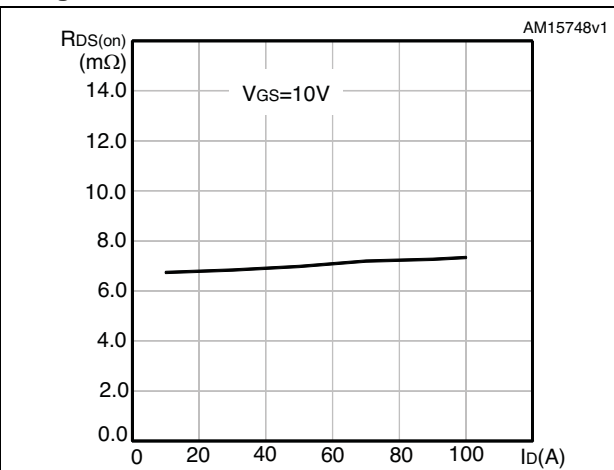


Figure 12. Gate charge vs gate-source voltage

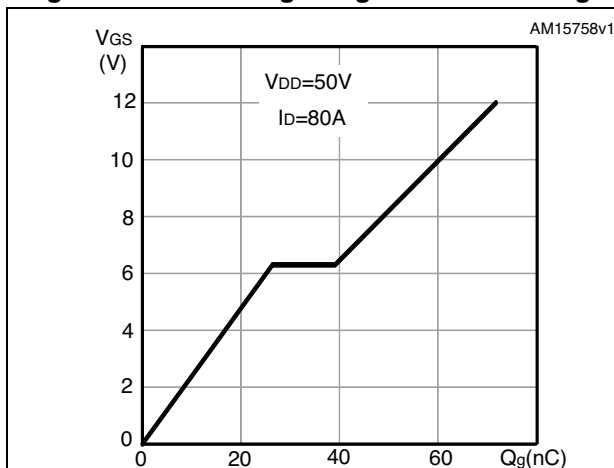


Figure 13. Capacitance variations

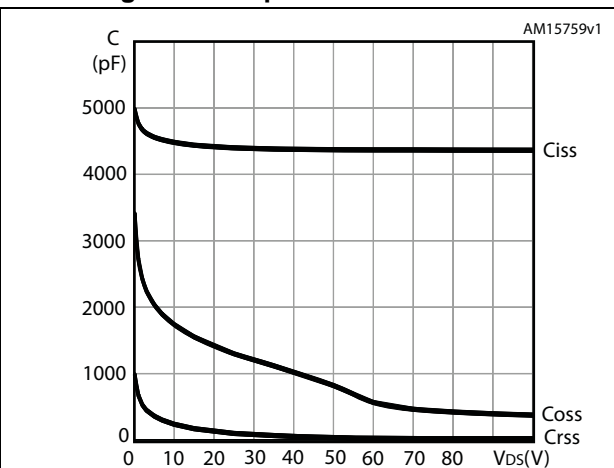


Figure 14. Normalized gate threshold voltage vs temperature

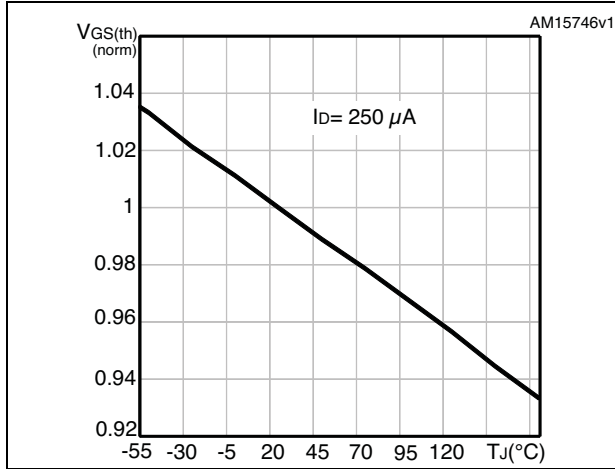


Figure 15. Normalized on-resistance vs temperature

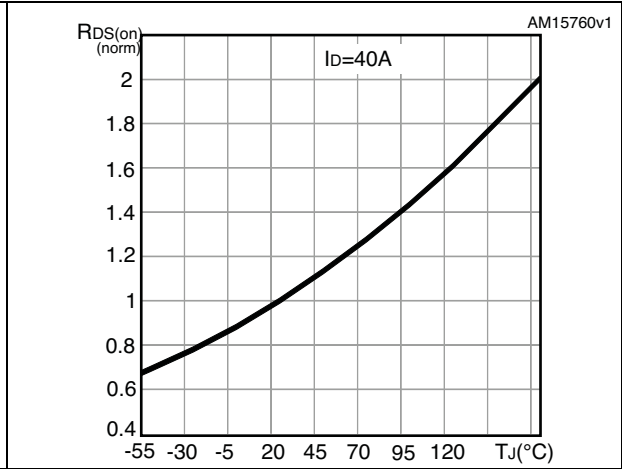
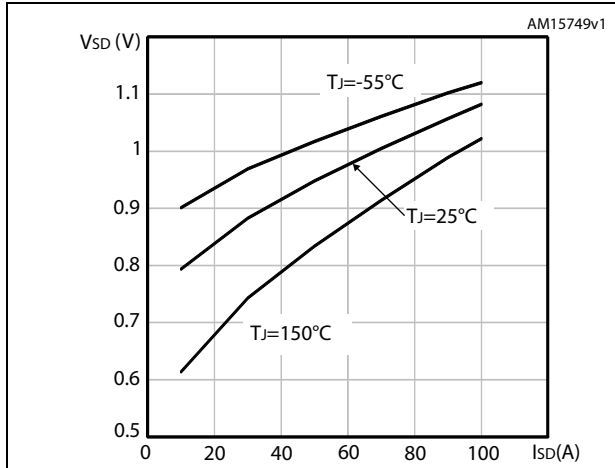


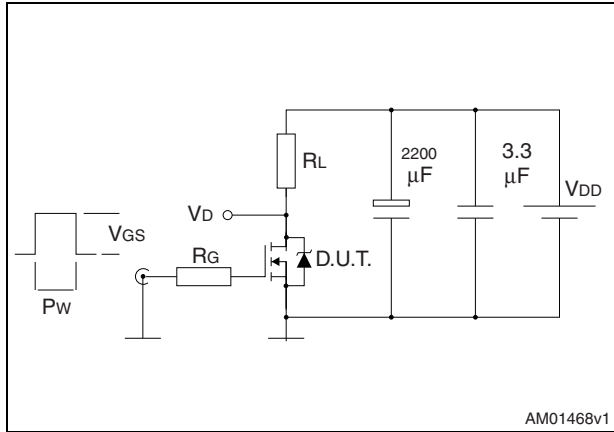
Figure 16. Source-drain diode forward characteristics



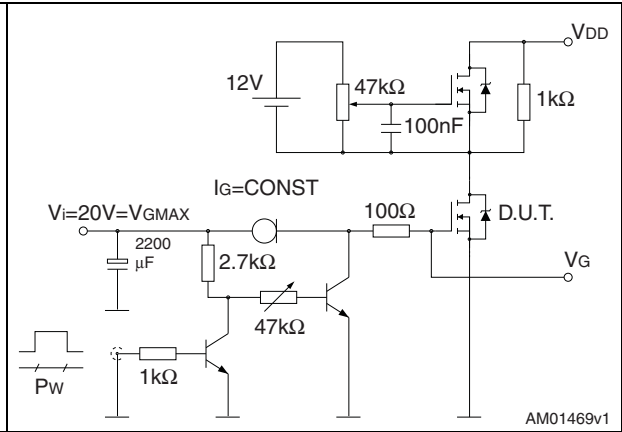


### 3 Test circuits

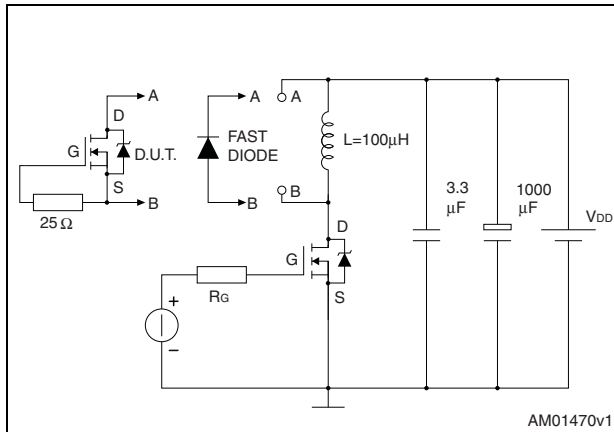
**Figure 17. Switching times test circuit for resistive load**



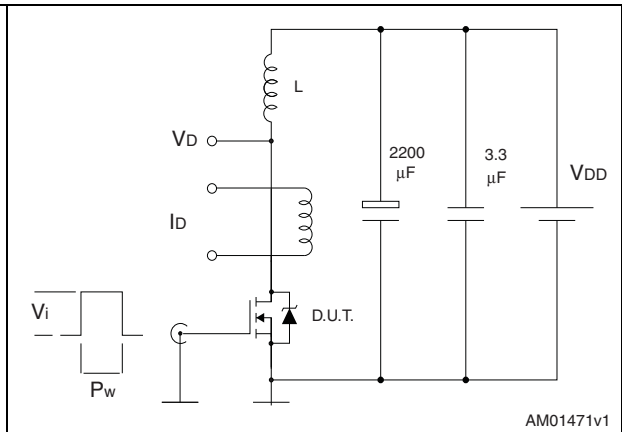
**Figure 18. Gate charge test circuit**



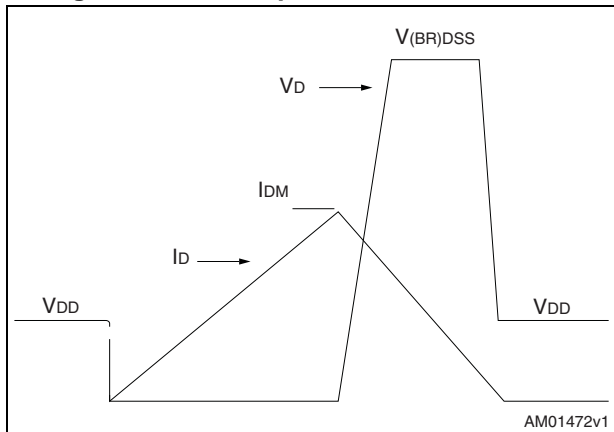
**Figure 19. Test circuit for inductive load switching and diode recovery times**



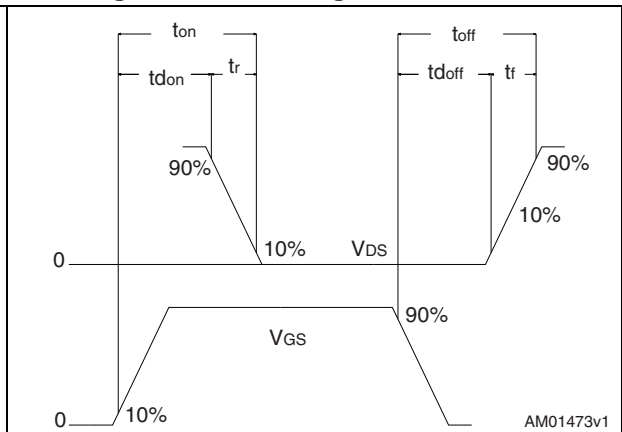
**Figure 20. Unclamped inductive load test circuit**



**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<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<sup>®</sup> is an ST trademark.

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 23. DPAK (TO-252) drawing

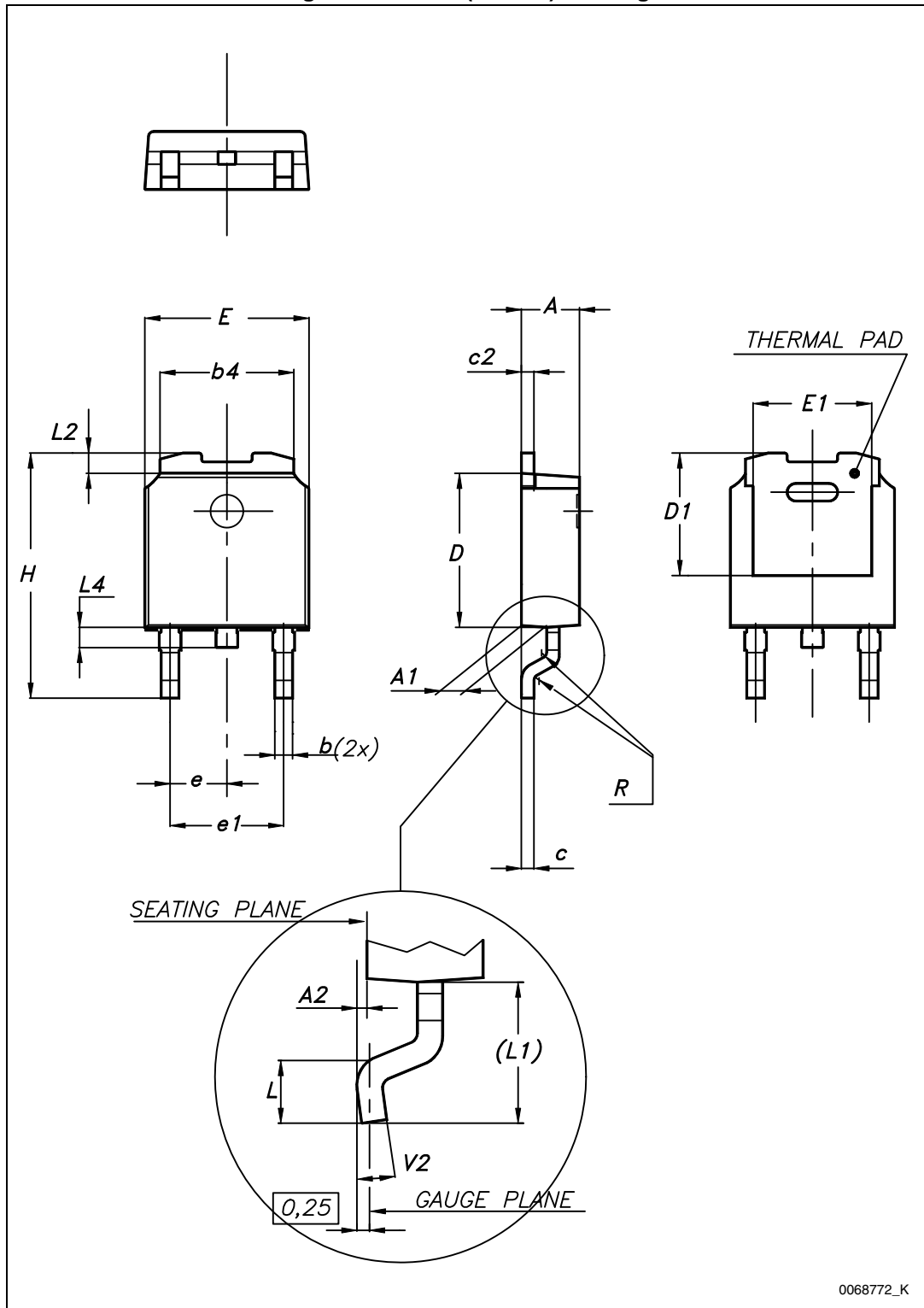
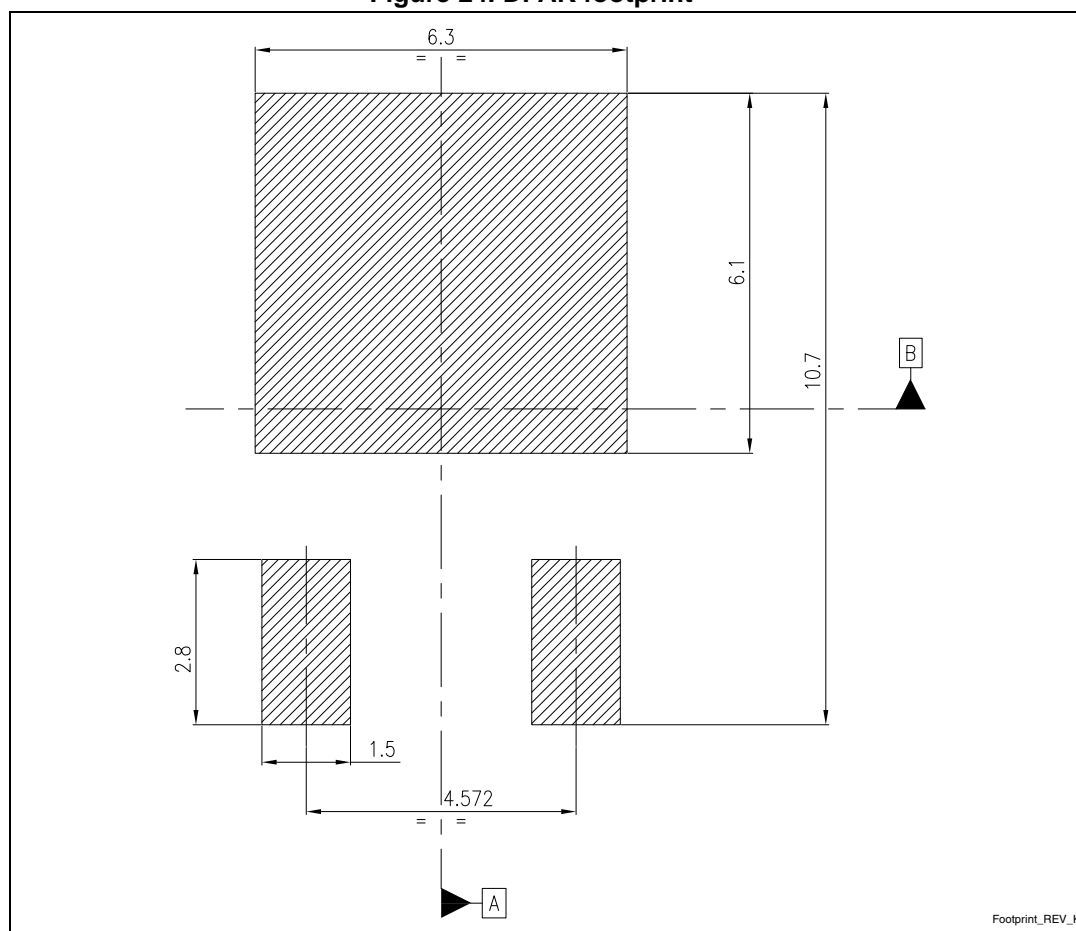


Figure 24. DPAK footprint (a)



a. 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 25. TO-220FP drawing

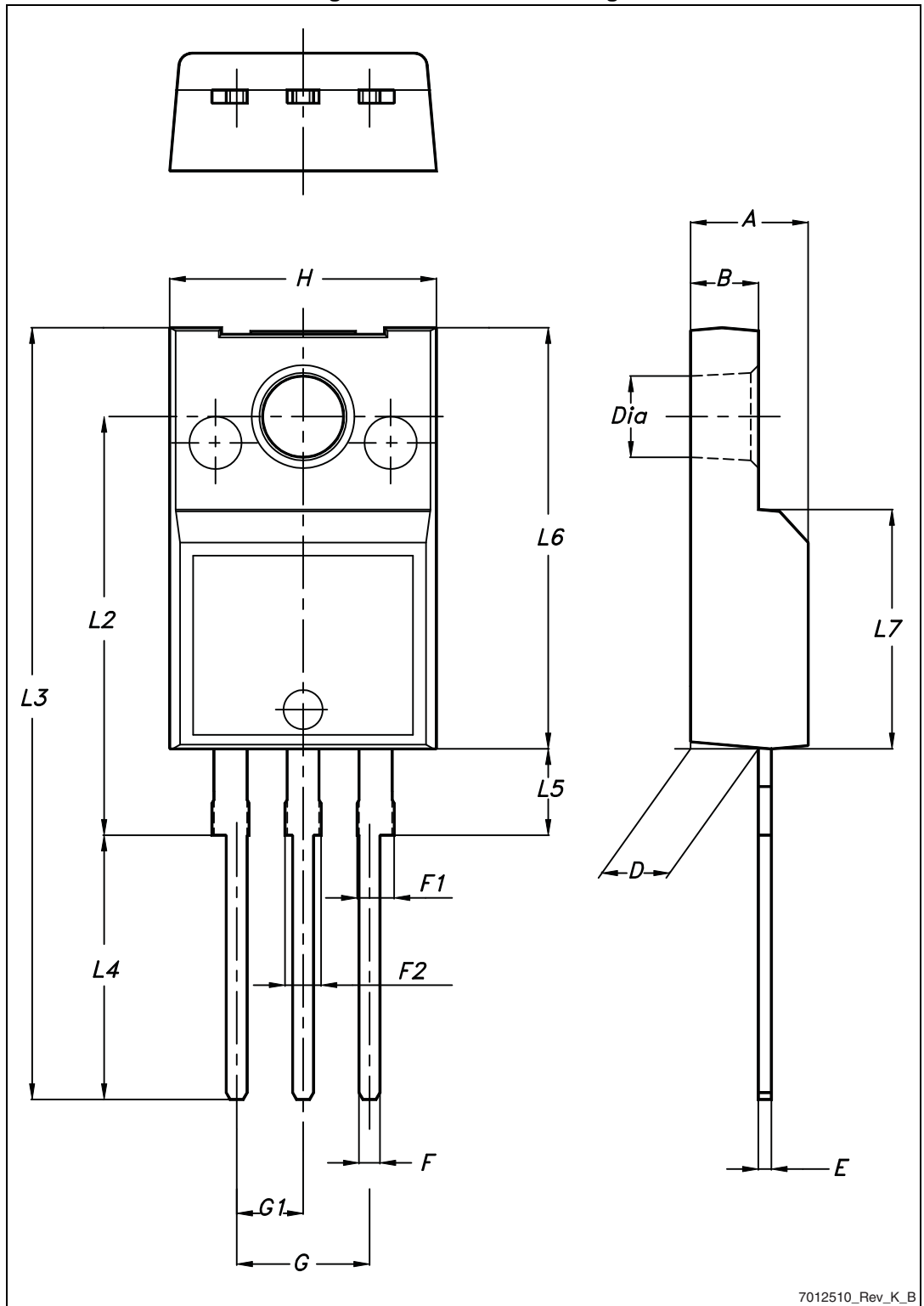
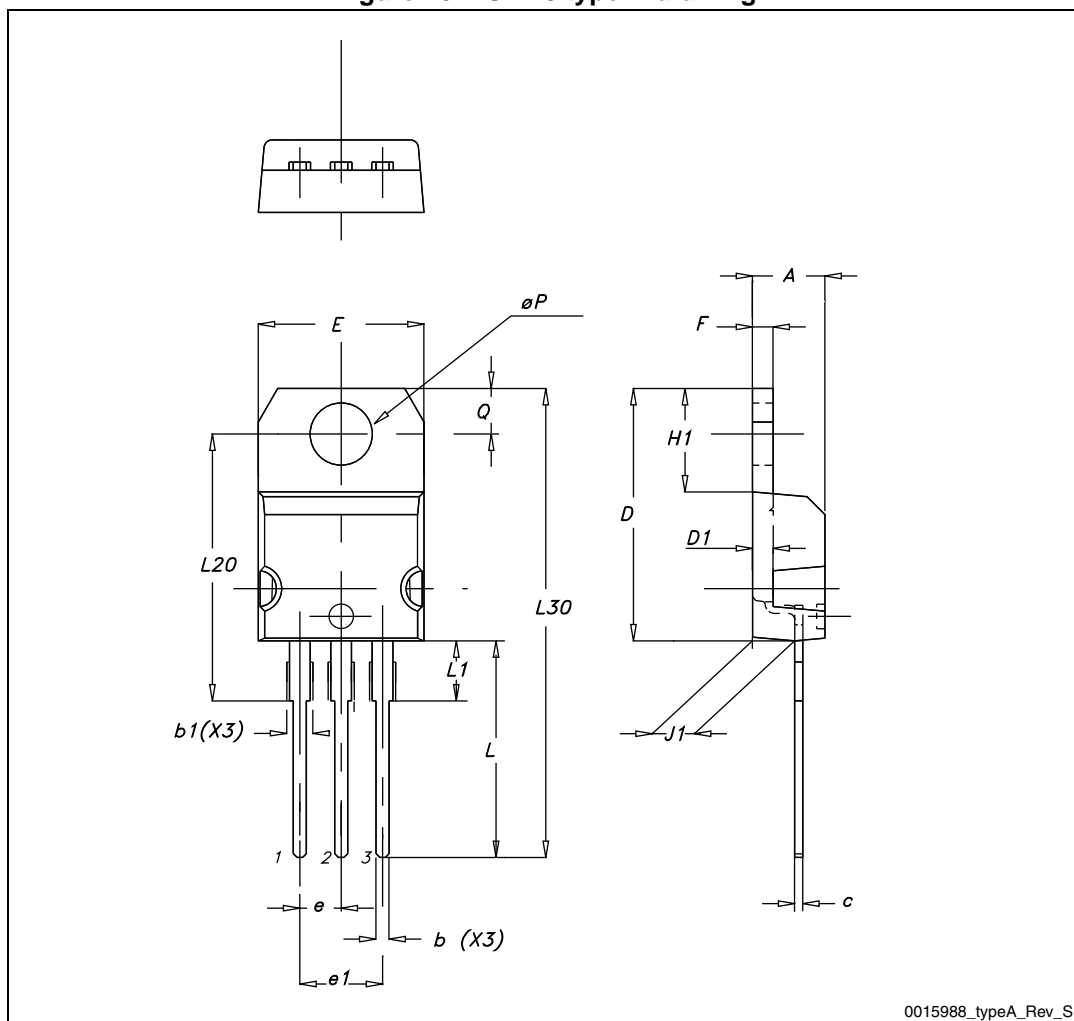


Table 11. TO-220 type A mechanical data

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	
ØP	3.75		3.85
Q	2.65		2.95



Figure 26. TO-220 type A drawing



0015988\_typeA\_Rev\_S

## 5 Packaging mechanical data

Table 12. 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
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

Figure 27. Tape for DPAK (TO-252)

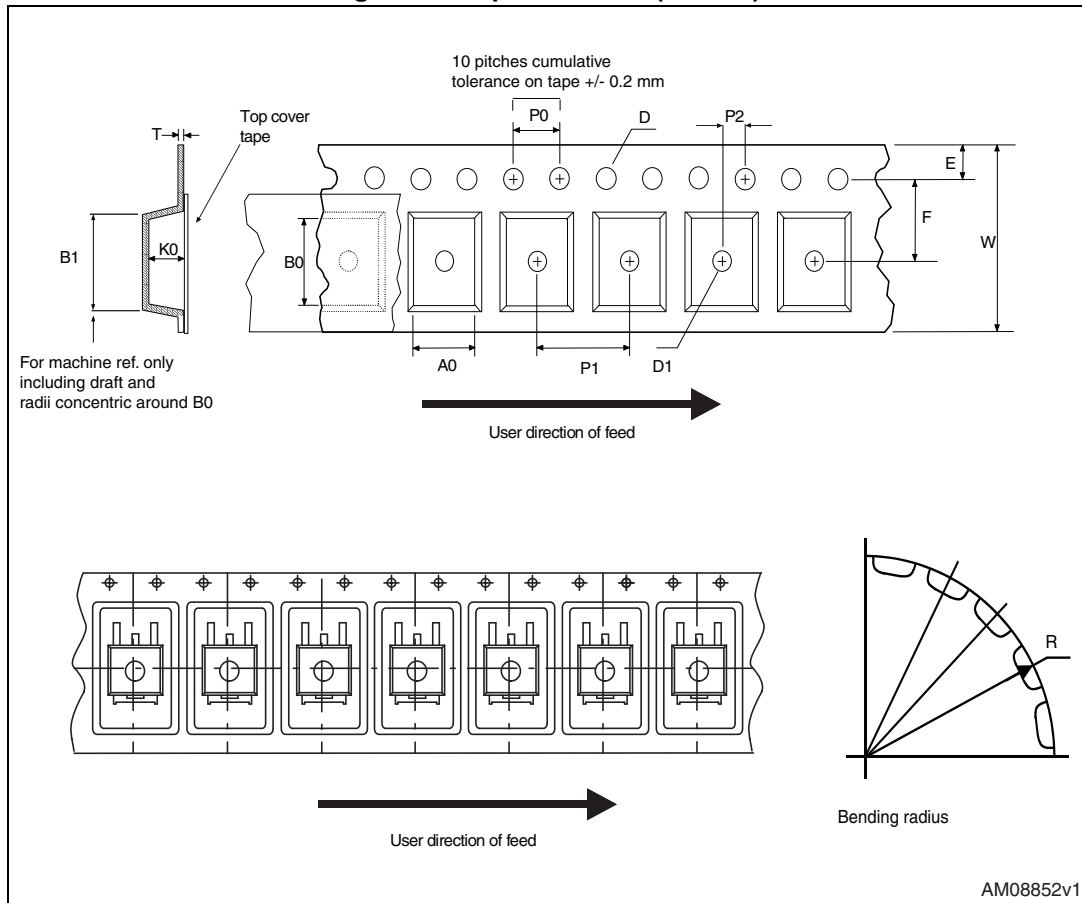
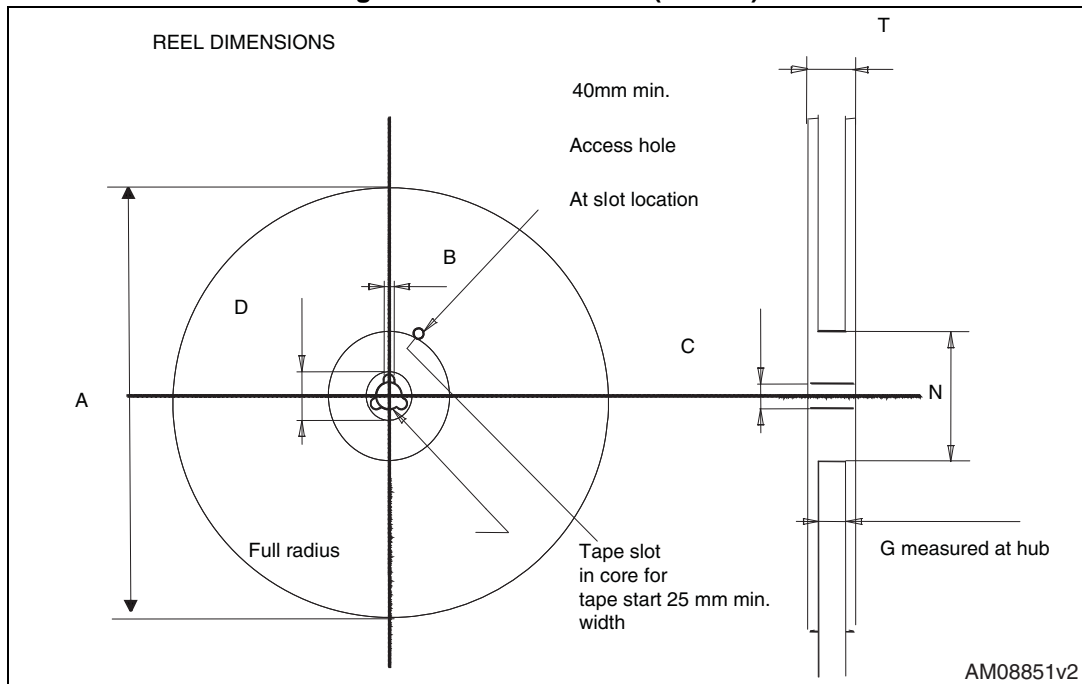


Figure 28. Reel for DPAK (TO-252)



## 6 Revision history

**Table 13. Document revision history**

Date	Revision	Changes
05-Oct-2012	1	First release.
07-Feb-2013	2	<ul style="list-style-type: none"> <li>– Inserted device in TO-220FP.</li> <li>– Updated title and features on the cover page, <a href="#">Table 1: Device summary</a>, <a href="#">Table 2: Absolute maximum ratings</a>, <a href="#">Table 3: Thermal resistance</a> and <a href="#">Table 5: On/off states</a> accordingly.</li> <li>– Updated <a href="#">Table 6: Dynamic</a>, <a href="#">Table 7: Switching times</a>, <a href="#">Table 8: Source drain diode</a> and <a href="#">Section 4: Package mechanical data</a>.</li> <li>– Added <a href="#">Section 5: Packaging mechanical data</a>.</li> </ul>
29-Apr-2013	3	<ul style="list-style-type: none"> <li>– Modified: the entire typical values in <a href="#">Table 6</a>, <math>t_f</math> typical value in <a href="#">Table 7</a>, <math>V_{SD}</math> and typical values for <math>t_{rr}</math>, <math>q_{rr}</math>, <math>I_{RRM}</math></li> <li>– Inserted: <a href="#">Table 4: Avalanche characteristics</a> and <a href="#">Section 2.1: Electrical characteristics (curves)</a></li> <li>– Minor text changes</li> </ul>

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