

N-channel 100 V, 0.027  $\Omega$  typ., 25 A, STripFET™ VII DeepGATE™ Power MOSFET in DPAK, TO-220FP and TO-220 packages

Datasheet - production data

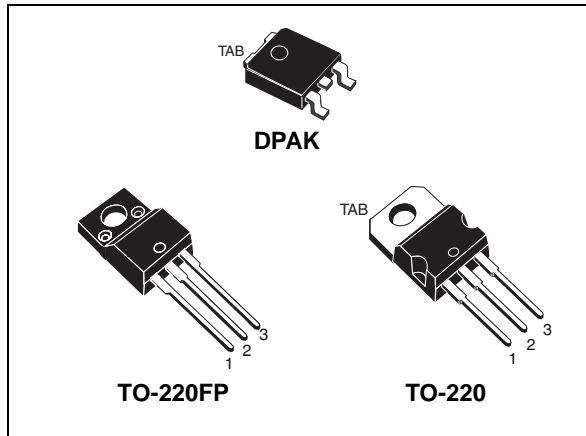
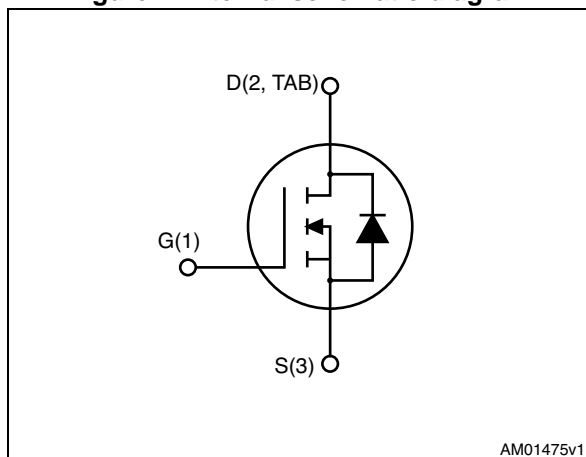


Figure 1. Internal schematic diagram



## Features

Order codes	V <sub>DSS</sub>	R <sub>DS(on)</sub> max. <sup>(1)</sup>	I <sub>D</sub>	P <sub>TOT</sub>
STD25N10F7	100 V	0.035 $\Omega$	25 A	40 W
STF25N10F7	100 V	0.035 $\Omega$	19 A	25 W
STP25N10F7	100 V	0.035 $\Omega$	25 A	50 W

1. @ V<sub>GS</sub> = 10 V

- 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<sub>DS(on)</sub> in all packages.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STD25N10F7	25N10F7	DPAK	Tape and reel
STF25N10F7	25N10F7	TO-220FP	Tube
STP25N10F7	25N10F7	TO-220	Tube

## Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value			Unit
		DPAK	TO-220	TO-220FP	
$V_{DS}$	Drain-source voltage	100			V
$V_{GS}$	Gate-source voltage	± 20			V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ °C}$	25	25	19	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ °C}$	18	18	13.5	A
$I_{DM}^{(2)}$	Drain current (pulsed)	100	100	76	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ °C}$	40	50	25	W
$V_{ISO}$	Insulation withstand voltage (RMS) from all three leads to external heat sink ( $t = 1\text{ s}$ ; $T_C = 25\text{ °C}$ )	-		2500	V
$T_J$	Operating junction temperature	-55 to 175			°C
$T_{stg}$	Storage temperature				°C

1. This value is rated according to  $R_{thj-c}$ .
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	3.75	6	3	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	62.5			°C/W
$R_{thj-pcb}$	Thermal resistance junction-pcb	50			°C/W

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ( $V_{GS} = 0$ )	$I_D = 250\ \mu A$	100		-	V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 100\text{ V}$ $V_{DS} = 100\text{ V}; T_C = 125\text{ °C}$			10 100	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 100$	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	$V_{GS} = 10\text{ V}, I_D = 12.5\text{ A}$		0.027	0.035	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 50\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$	-	920	-	pF
$C_{oss}$	Output capacitance		-	215	-	pF
$C_{rss}$	Reverse transfer capacitance		-	19	-	pF
$Q_g$	Total gate charge	$V_{DD} = 50\text{ V}, I_D = 25\text{ A}$ $V_{GS} = 10\text{ V}$ <i>Figure 18</i>	-	14	-	nC
$Q_{gs}$	Gate-source charge		-	7	-	nC
$Q_{gd}$	Gate-drain charge		-	3	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 50\text{ V}$ , $I_D = 12.5\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ <i>Figure 17</i>	-	9.8	-	ns
$t_r$	Rise time		-	14	-	ns
$t_{d(off)}$	Turn-off delay time		-	14.8	-	ns
$t_f$	Fall time		-	4.6	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		25	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		100	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 25\text{ A}$ , $V_{GS} = 0$	-		1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 25\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 80\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$	-	38		ns
$Q_{rr}$	Reverse recovery charge		-	29		nC
$I_{RRM}$	Reverse recovery current		-	1.7		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

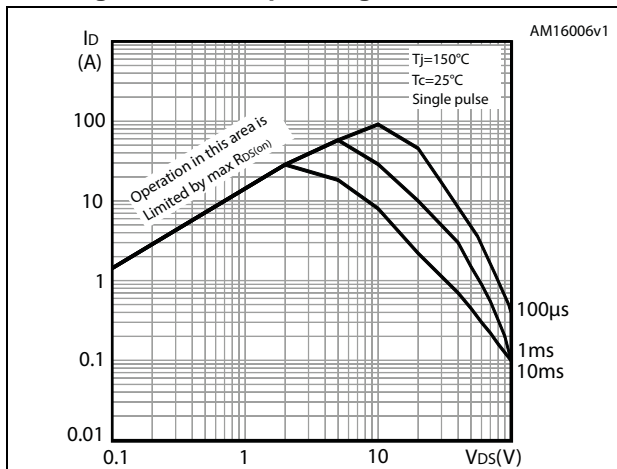


Figure 3. Thermal impedance for DPAK

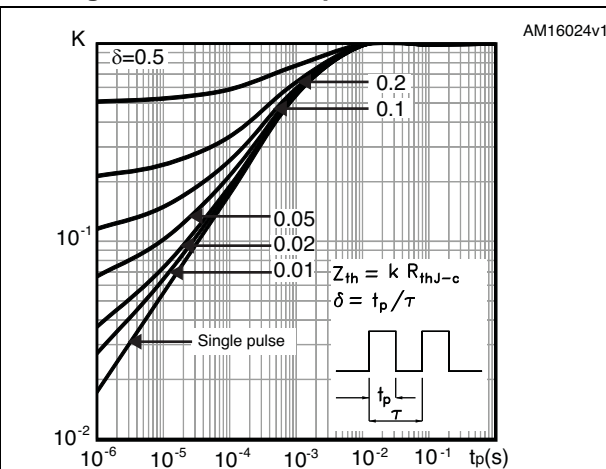


Figure 4. Safe operating area for TO-220FP

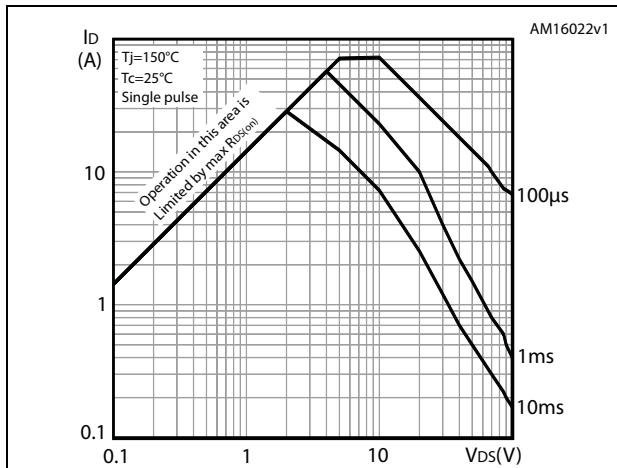


Figure 5. Thermal impedance for TO-220FP

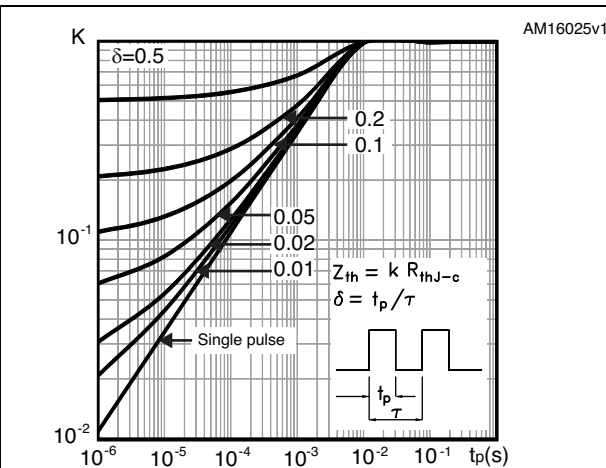


Figure 6. Safe operating area for TO-220

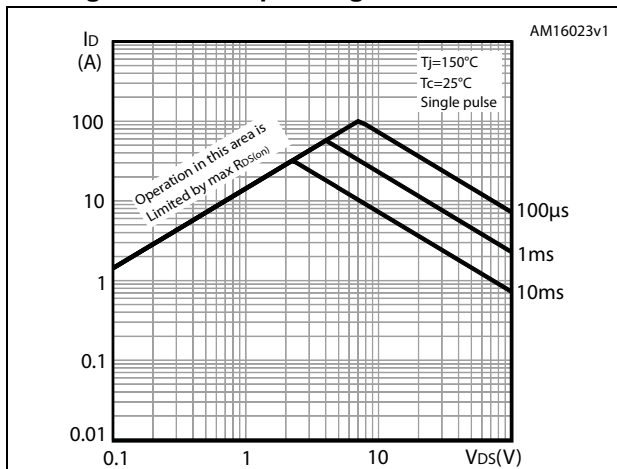


Figure 7. Thermal impedance for TO-220

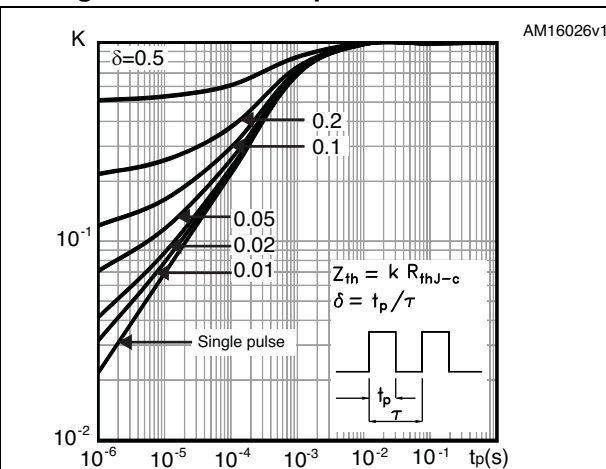


Figure 8. Output characteristics

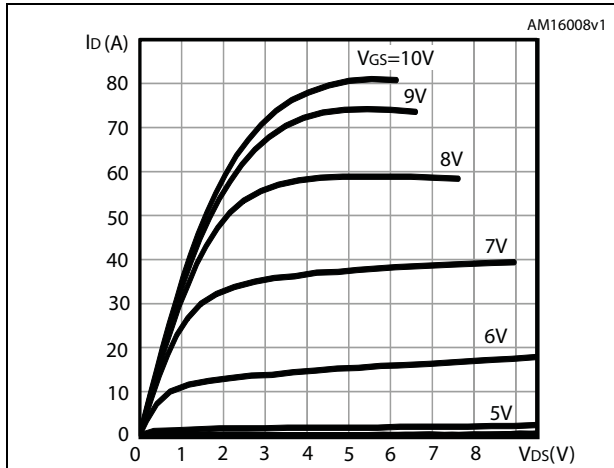


Figure 9. Transfer characteristics

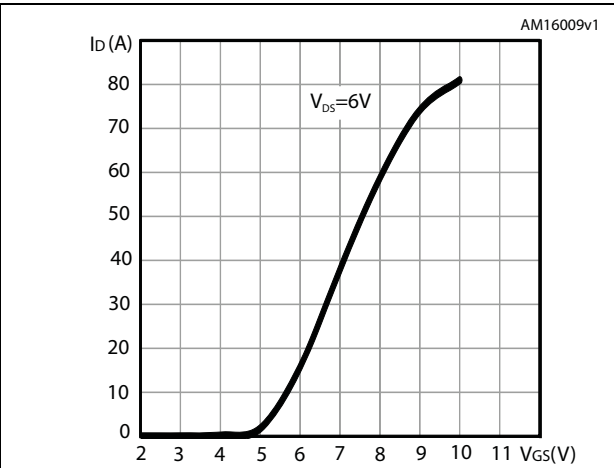


Figure 10. Gate charge vs gate-source voltage

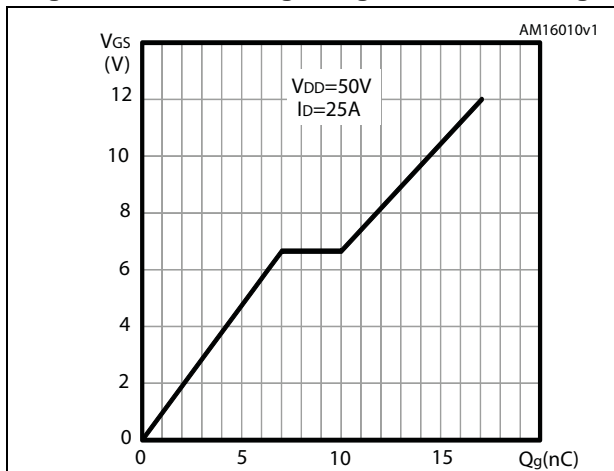


Figure 11. Static drain-source on-resistance

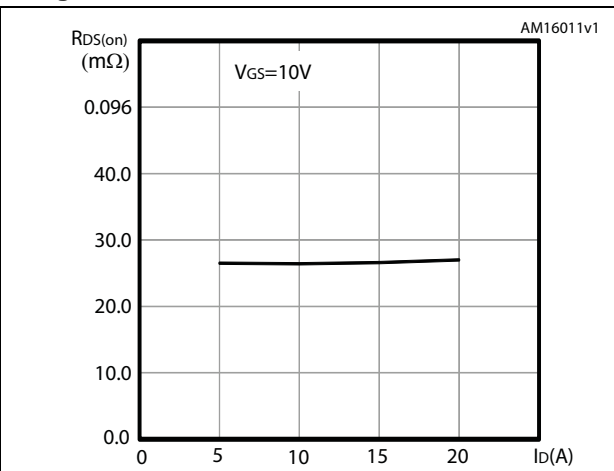


Figure 12. Capacitance variations

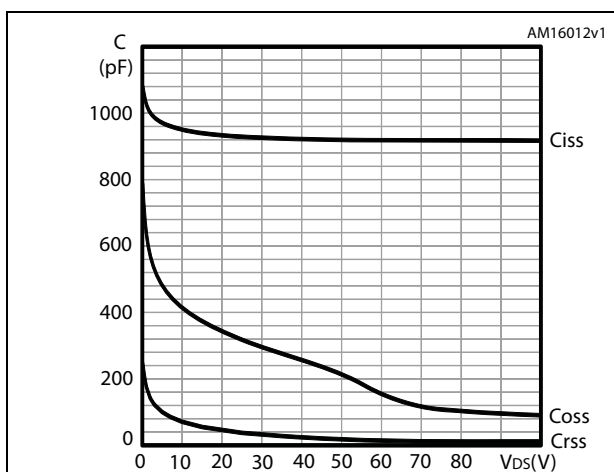


Figure 13. Normalized gate threshold voltage vs temperature

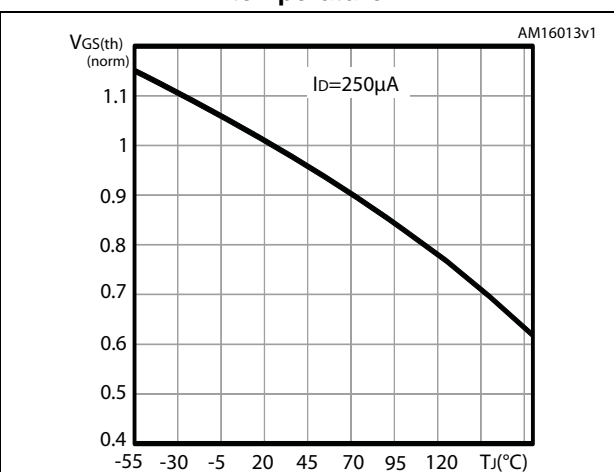


Figure 14. Normalized on-resistance vs temperature

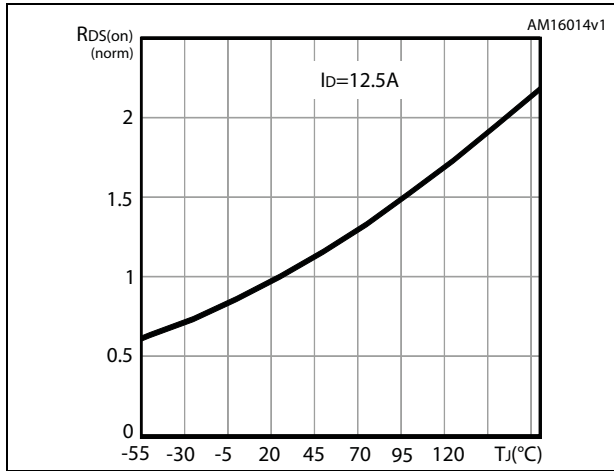


Figure 15. Normalized  $B_{V_{DSS}}$  vs temperature

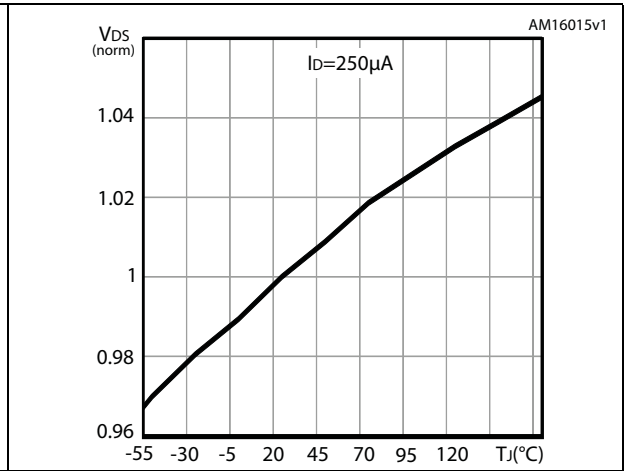
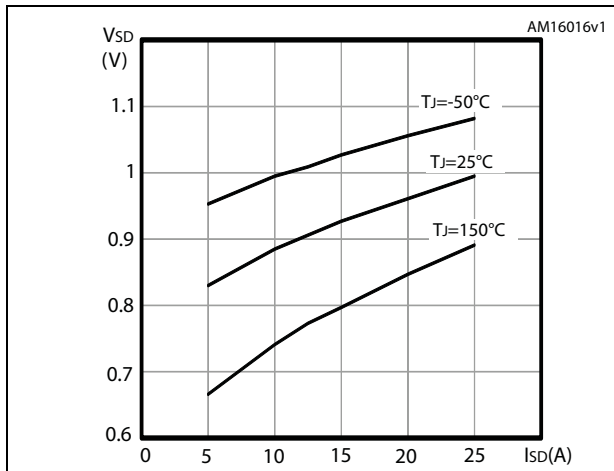


Figure 16. Source-drain diode forward characteristics





### 3 Test circuits

Figure 17. Switching times test circuit for resistive load

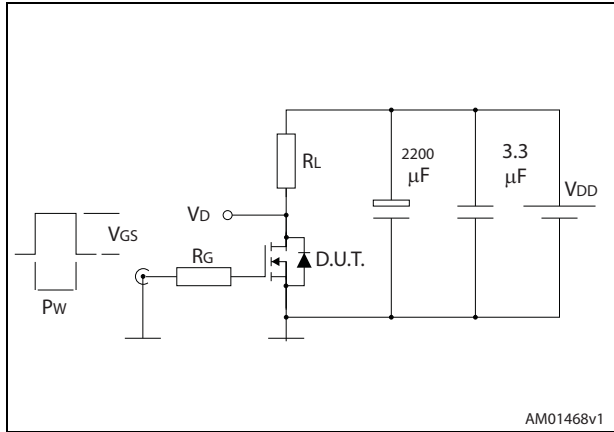


Figure 18. Gate charge test circuit

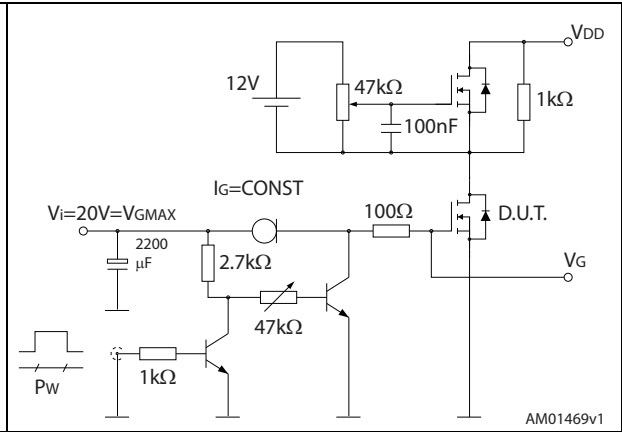


Figure 19. Test circuit for inductive load switching and diode recovery times

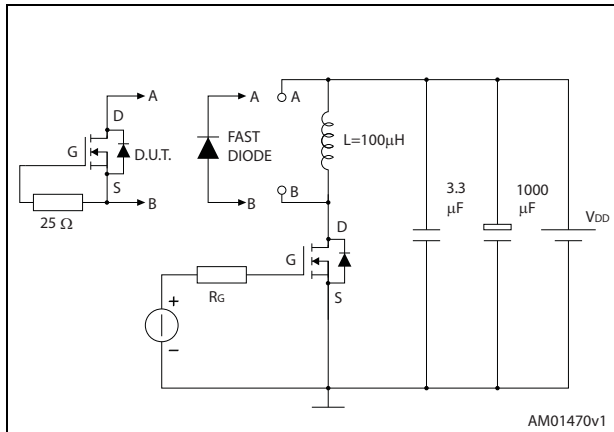


Figure 20. Unclamped inductive load test circuit

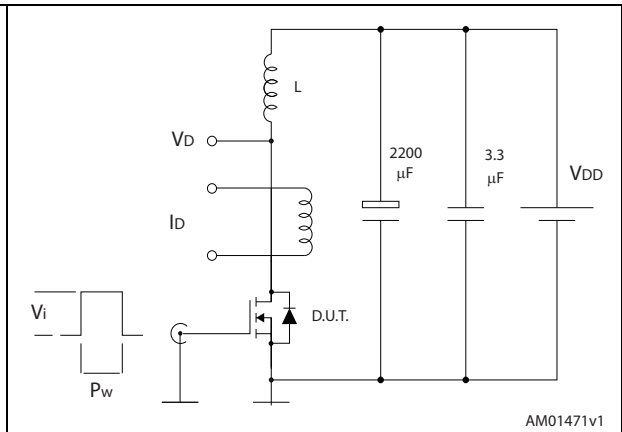


Figure 21. Unclamped inductive waveform

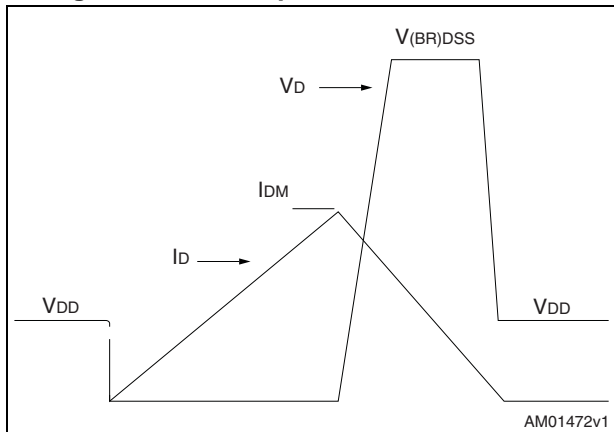
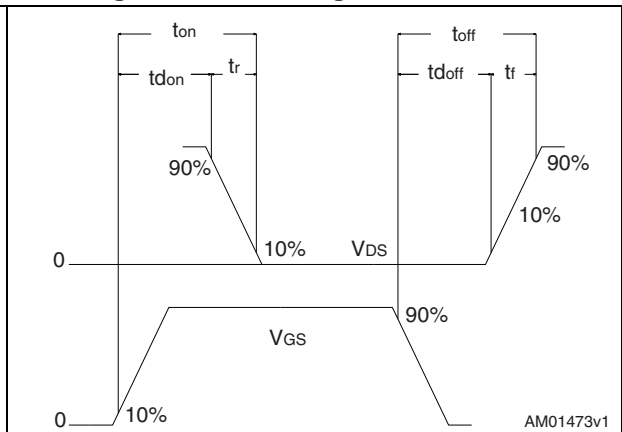


Figure 22. Switching time waveform



## 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 8. 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) drawings

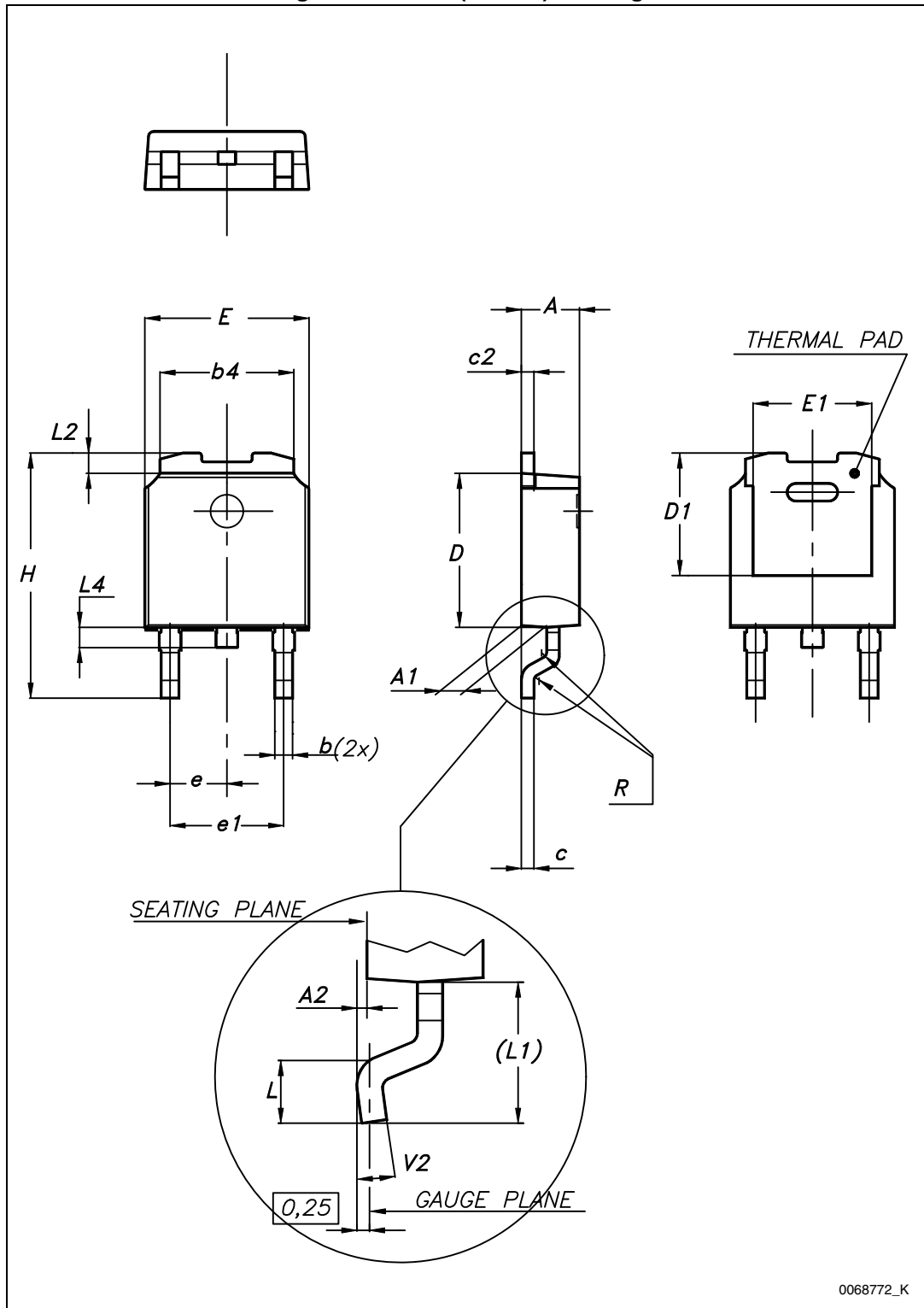
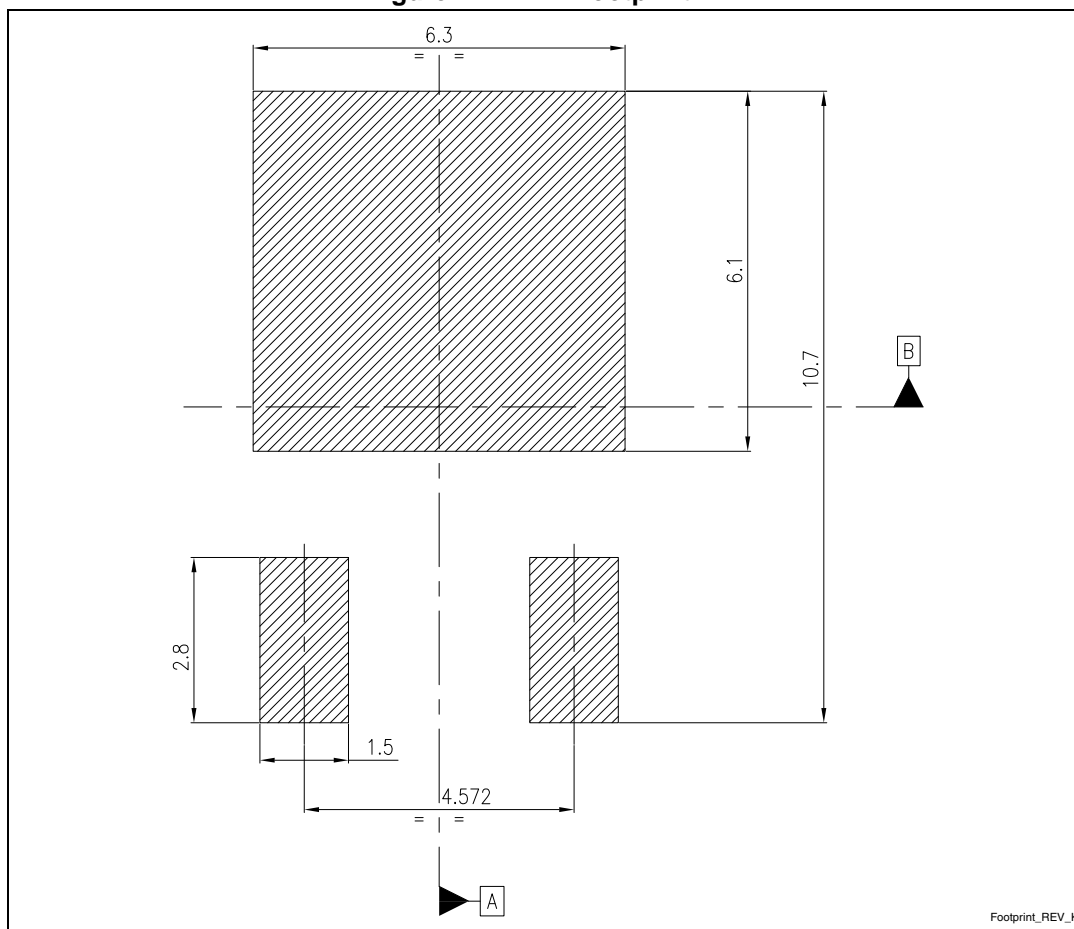


Figure 24. DPAK footprint (a)



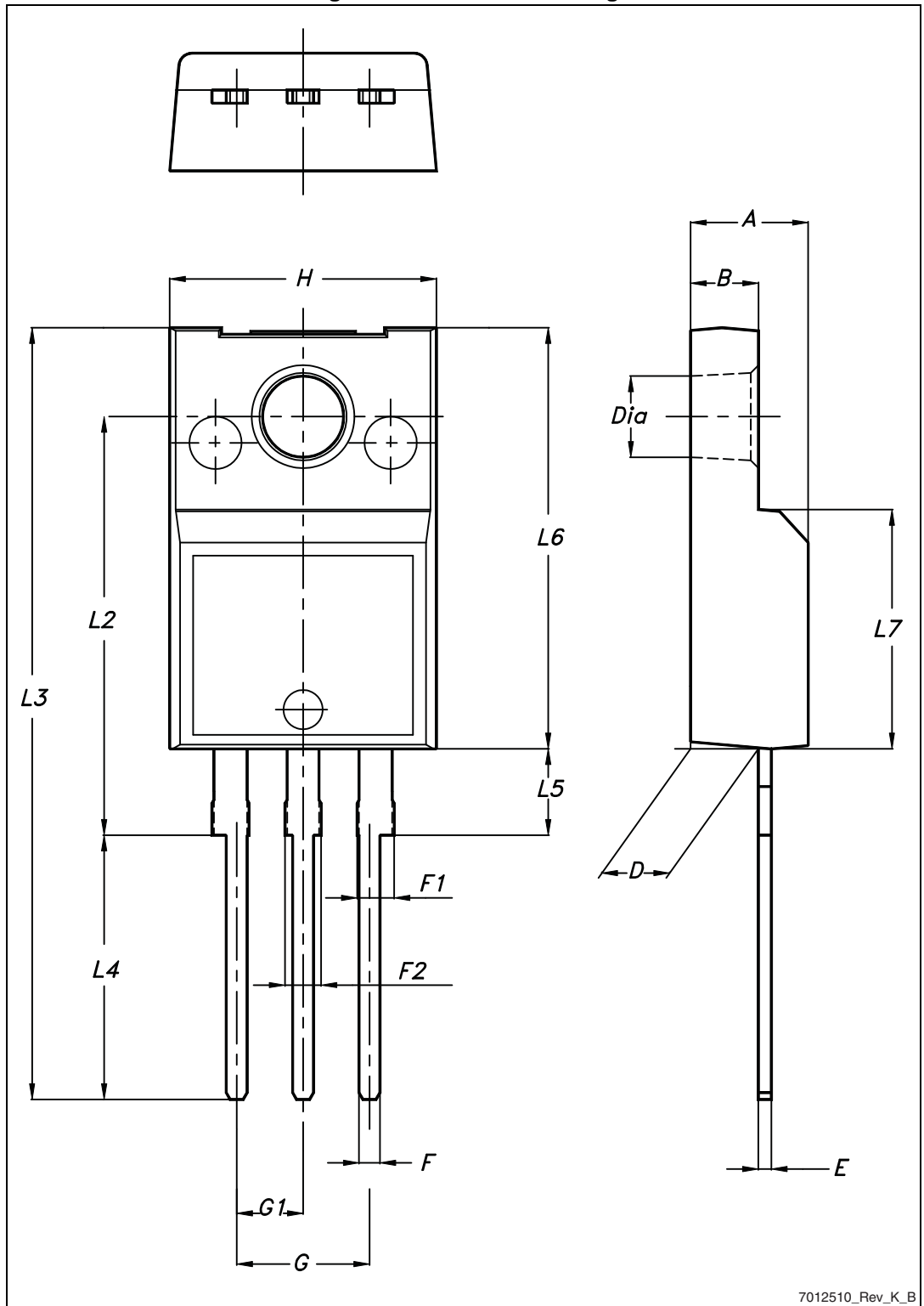
Footprint\_REV\_K

a. All dimensions are in millimeters

Table 9. 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



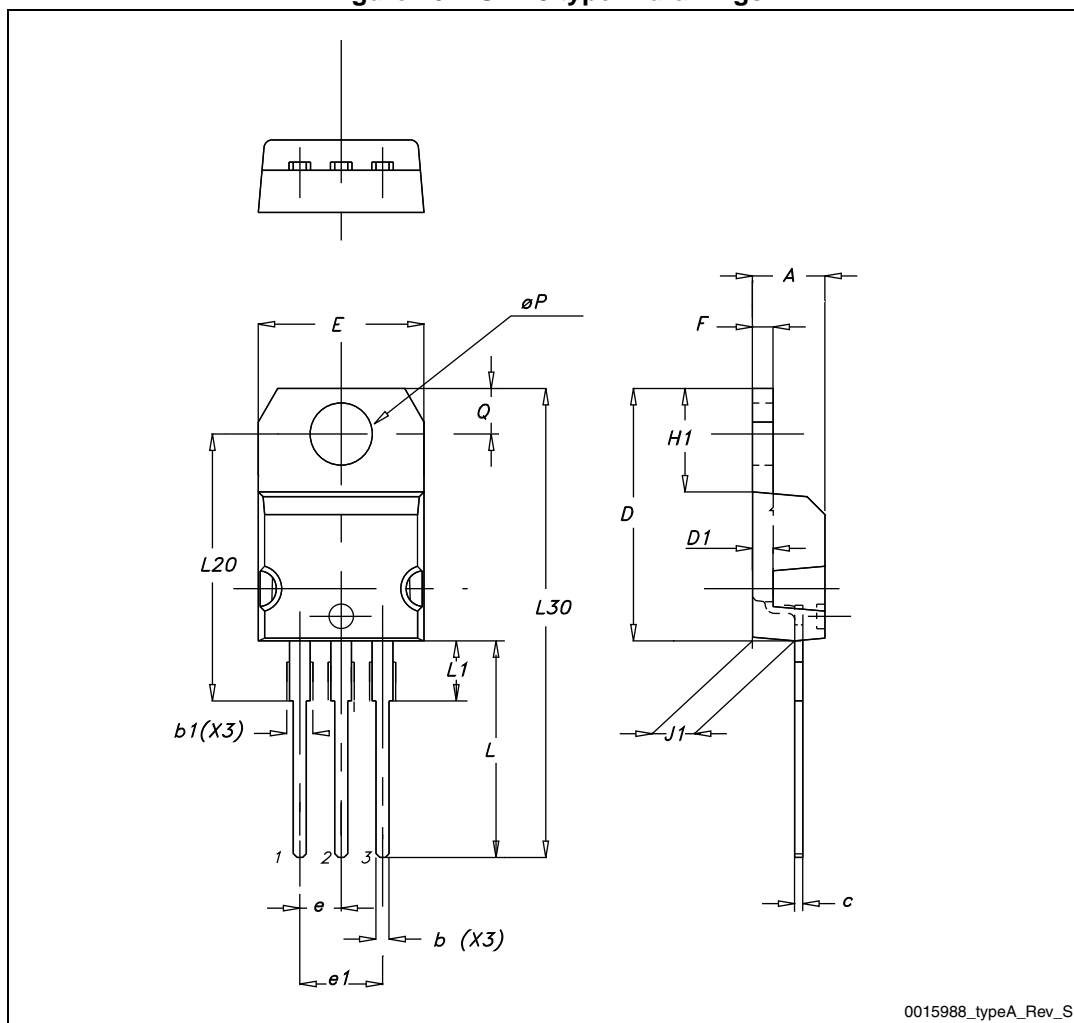
7012510\_Rev\_K\_B

Table 10. 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 drawings



0015988\_typeA\_Rev\_S

## 5 Packaging mechanical data

Table 11. 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)

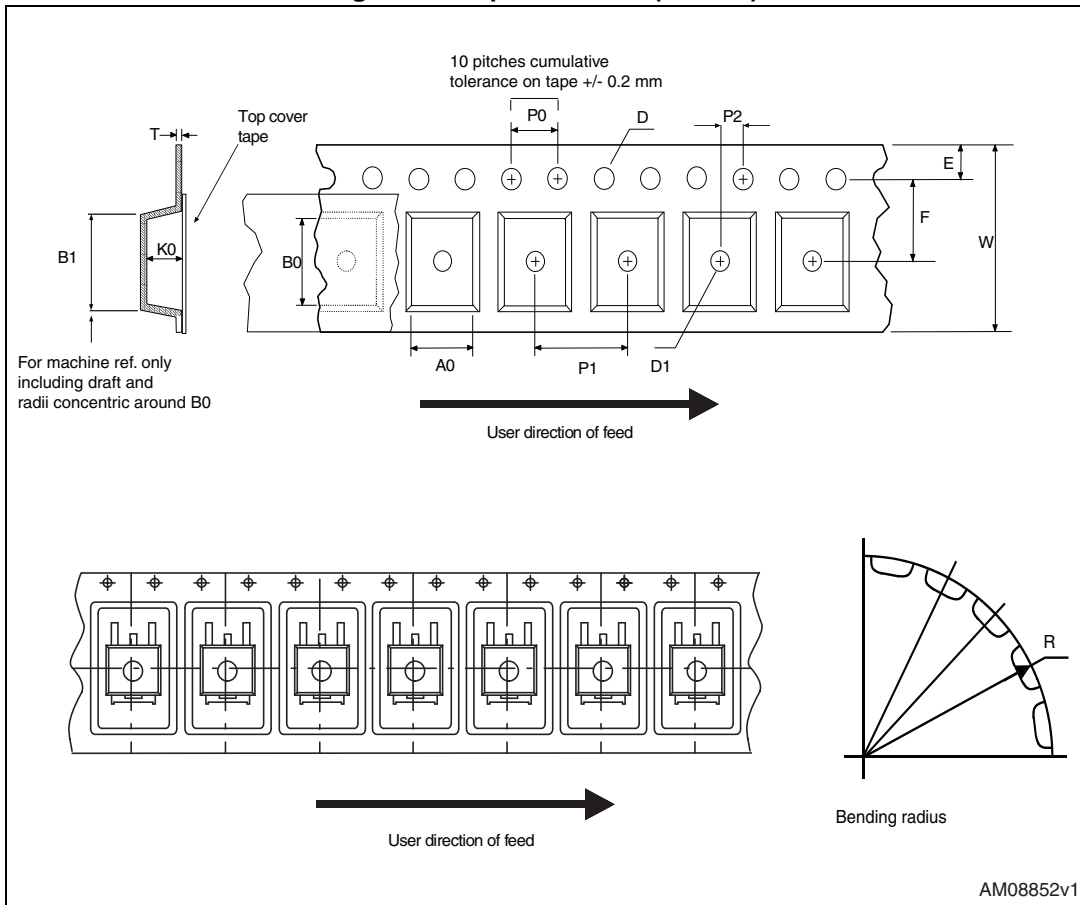
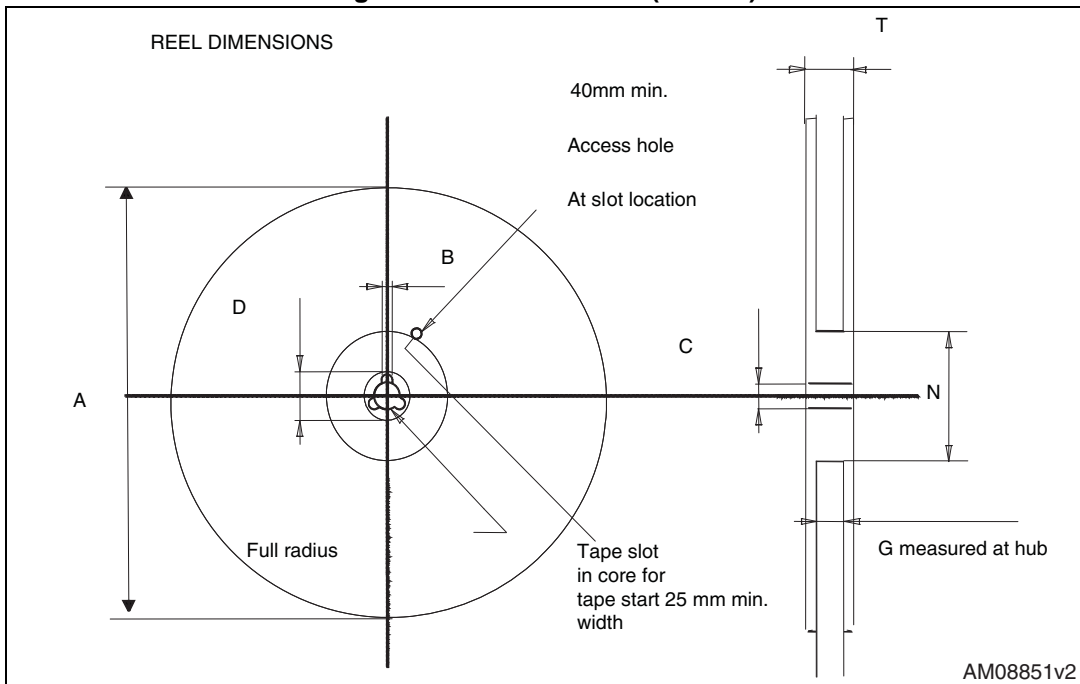


Figure 28. Reel for DPAK (TO-252)



## 6 Revision history

Table 12. Document revision history

Date	Revision	Changes
17-Sep-2013	1	First release.

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