

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

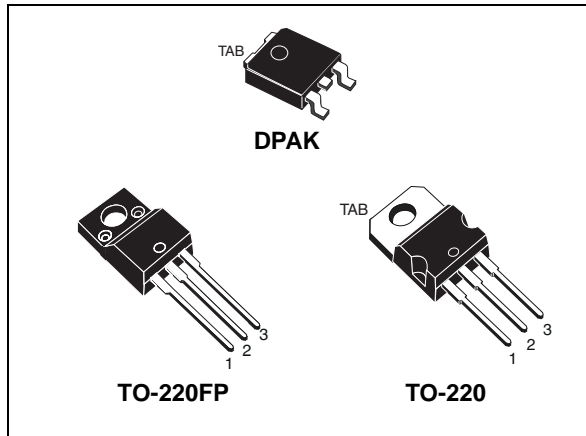
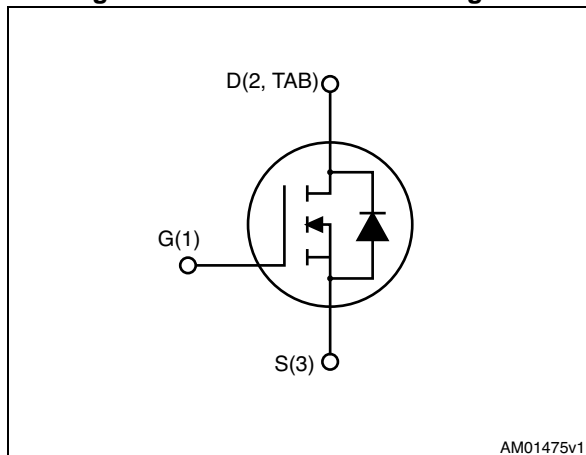


Figure 1. Internal schematic diagram



## 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

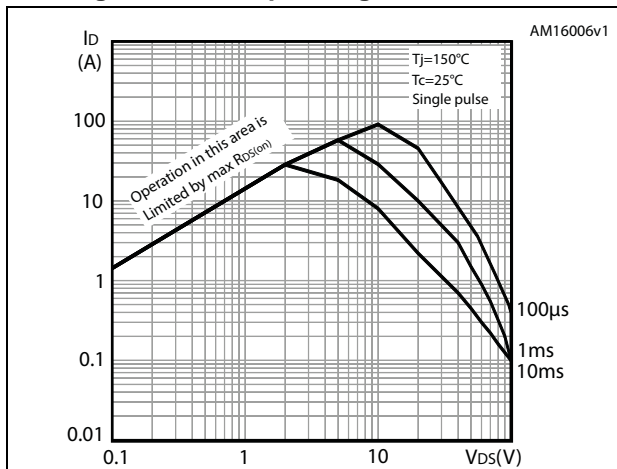


Figure 3. Thermal impedance for DPAK

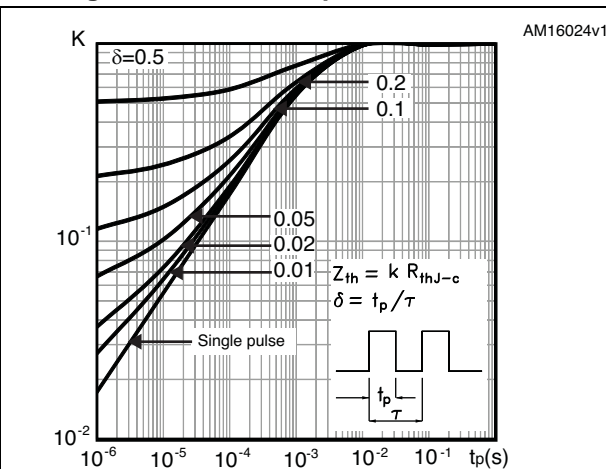


Figure 4. Safe operating area for TO-220FP

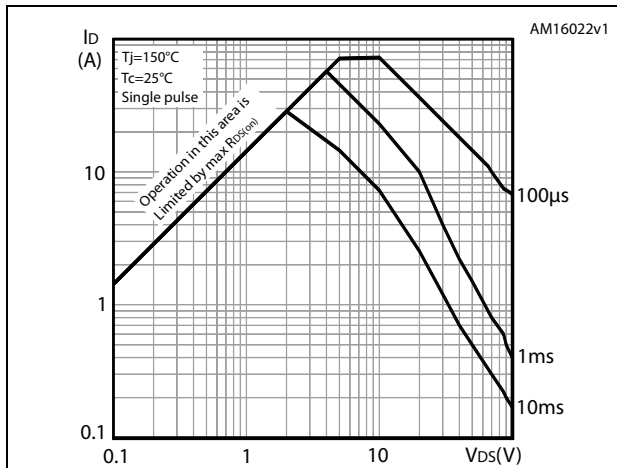


Figure 5. Thermal impedance for TO-220FP

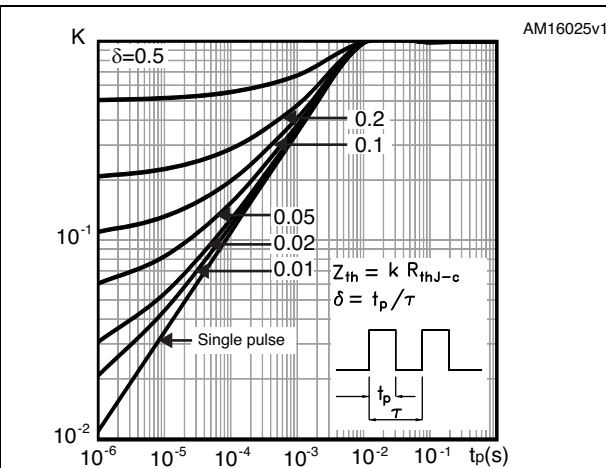


Figure 6. Safe operating area for TO-220

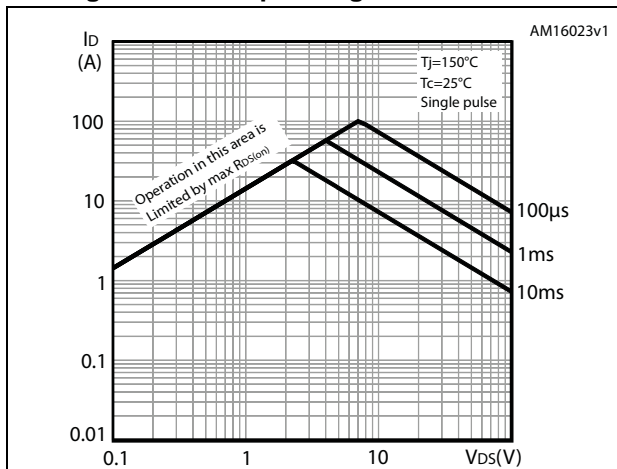


Figure 7. Thermal impedance for TO-220

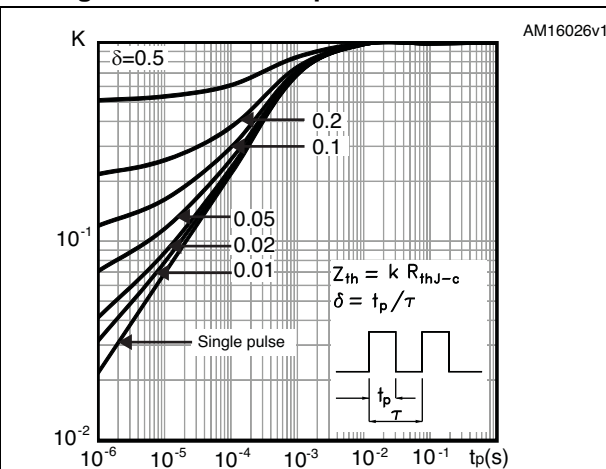


Figure 8. Output characteristics

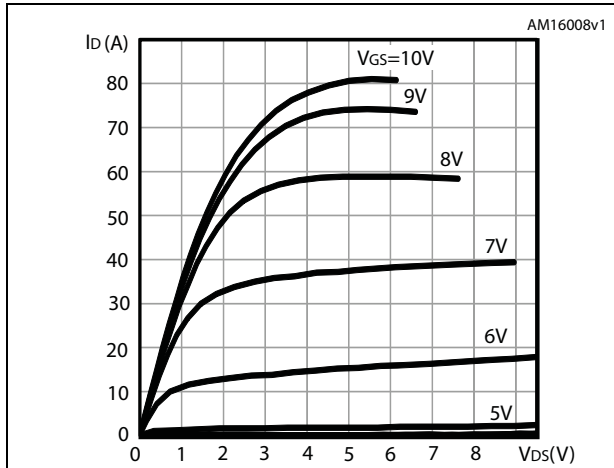


Figure 9. Transfer characteristics

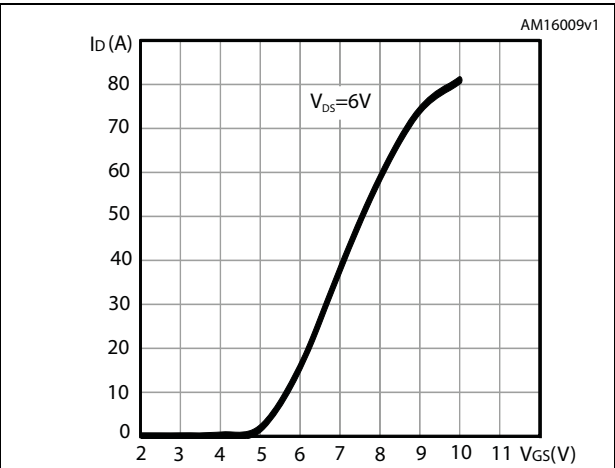


Figure 10. Gate charge vs gate-source voltage

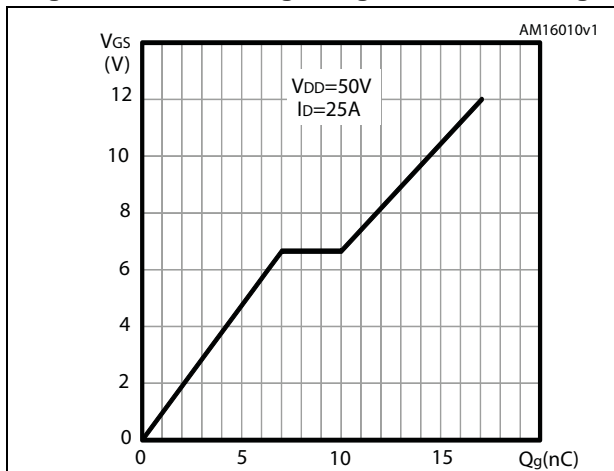


Figure 11. Static drain-source on-resistance

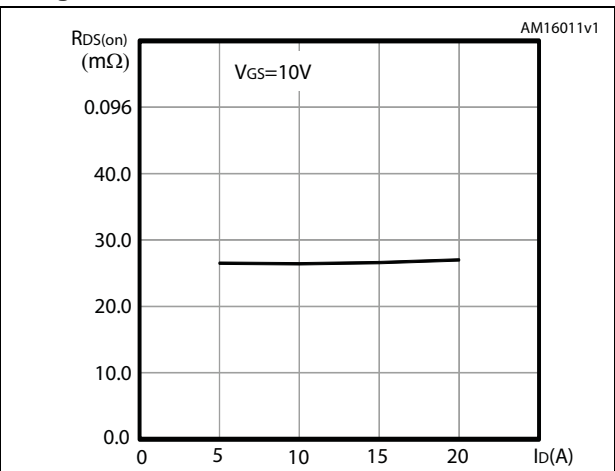


Figure 12. Capacitance variations

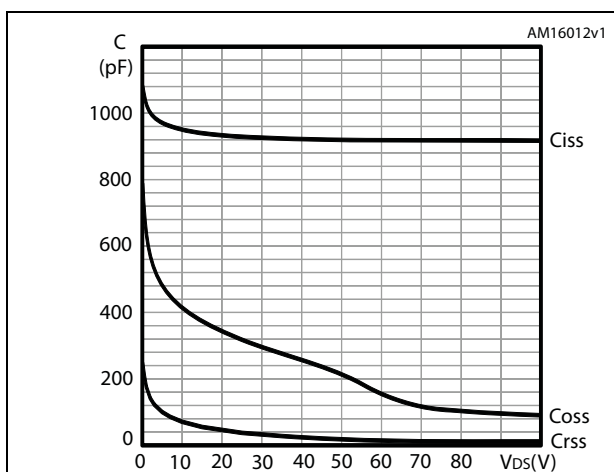


Figure 13. Normalized gate threshold voltage vs temperature

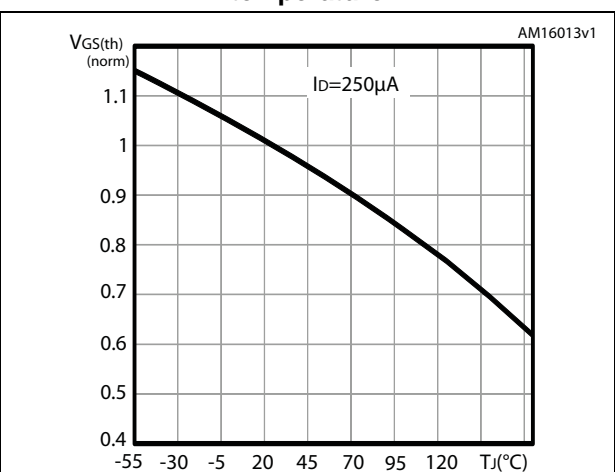


Figure 14. Normalized on-resistance vs temperature

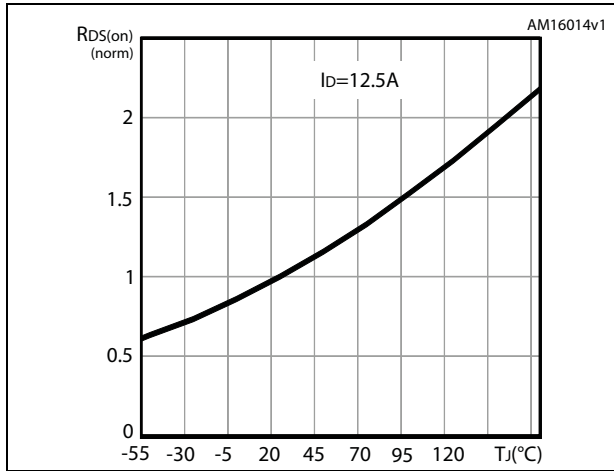


Figure 15. Normalized  $B_{V_{DSS}}$  vs temperature

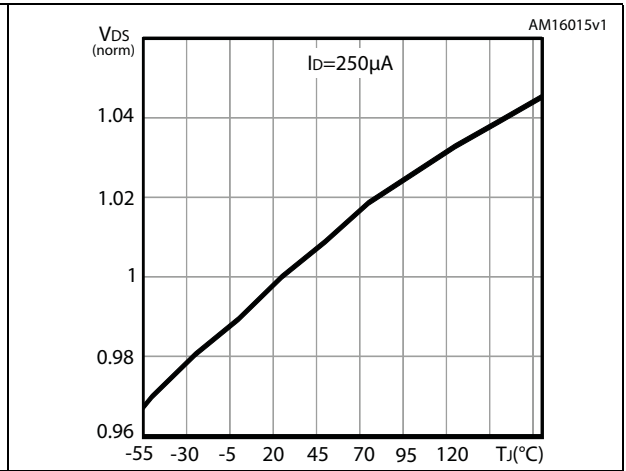
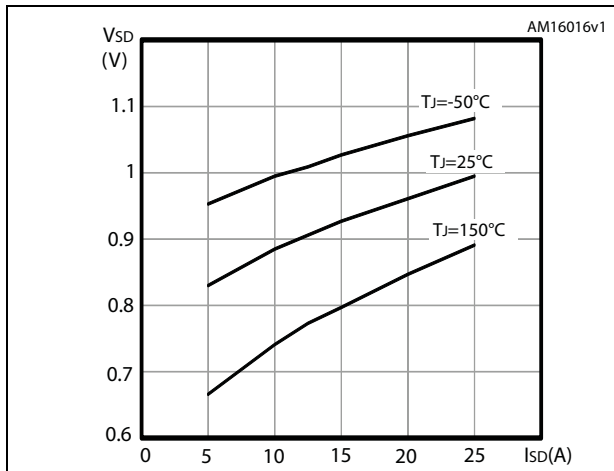


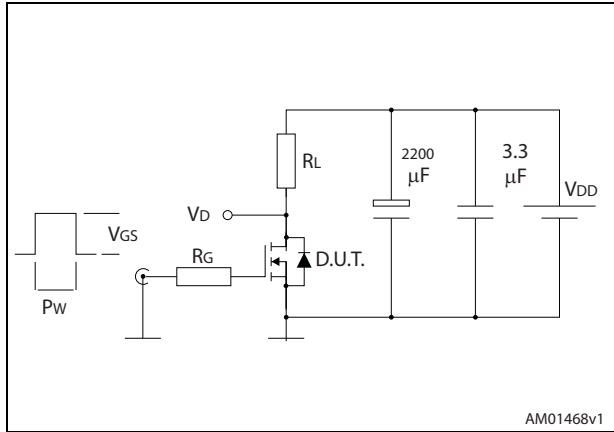
Figure 16. Source-drain diode forward characteristics





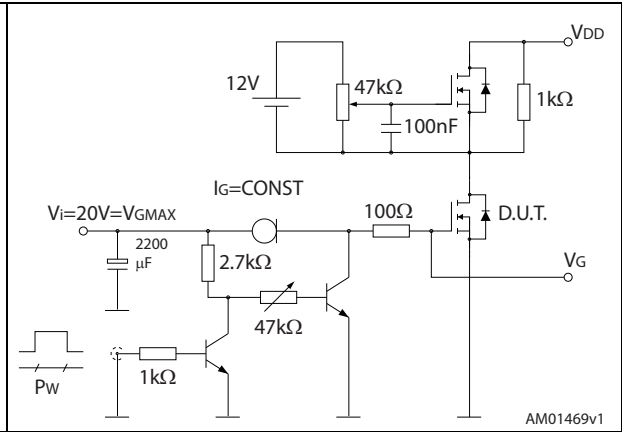
### 3 Test circuits

Figure 17. Switching times test circuit for resistive load



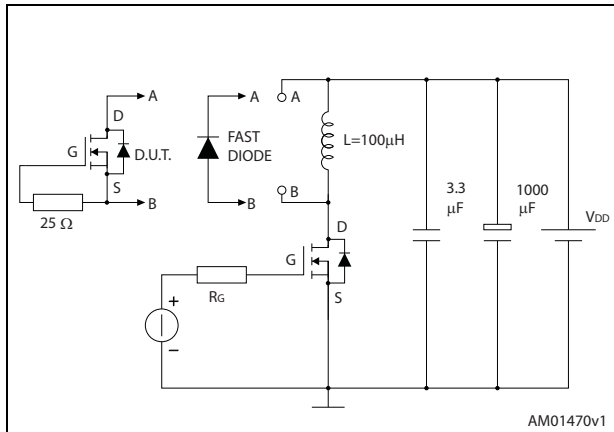
AM01468v1

Figure 18. Gate charge test circuit



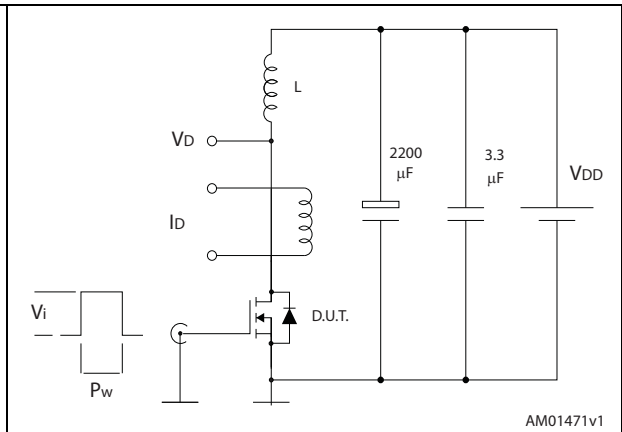
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Figure 19. Test circuit for inductive load switching and diode recovery times



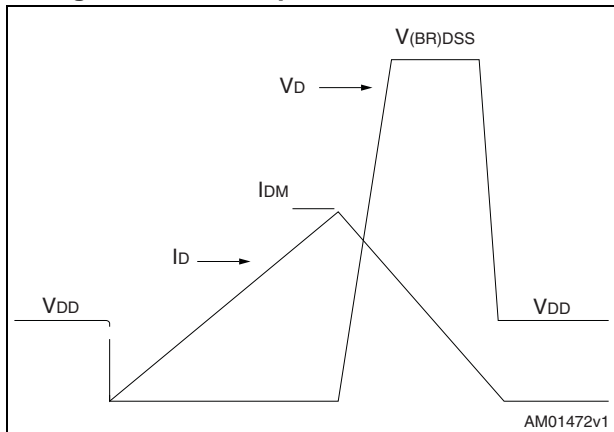
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Figure 20. Unclamped inductive load test circuit



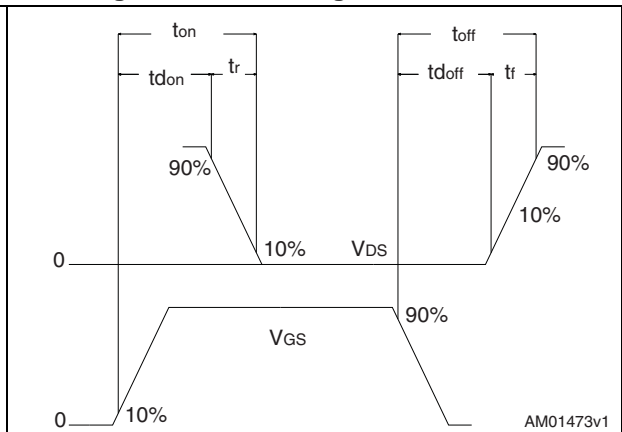
AM01471v1

Figure 21. Unclamped inductive waveform



AM01472v1

Figure 22. Switching time waveform



AM01473v1

## 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

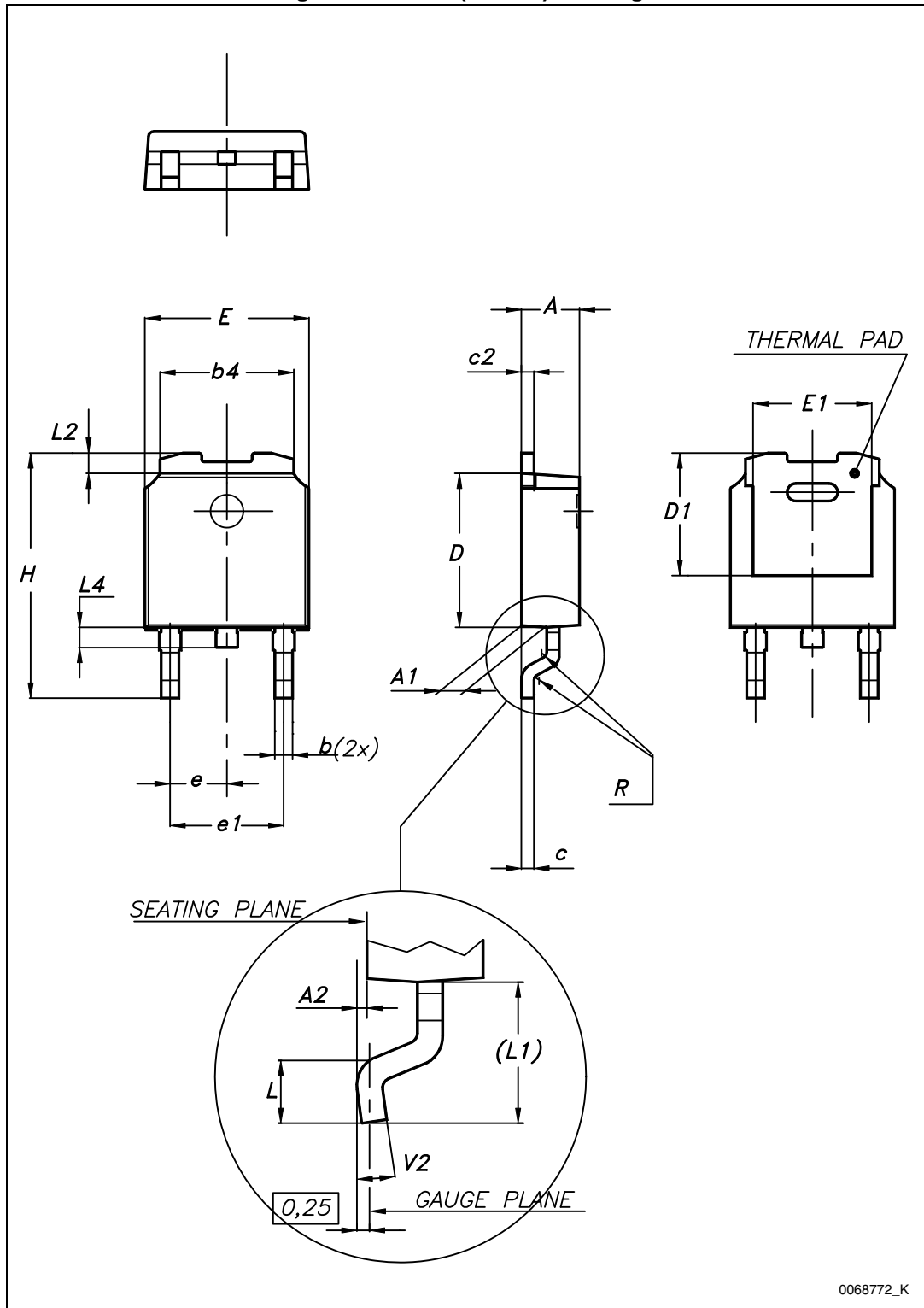
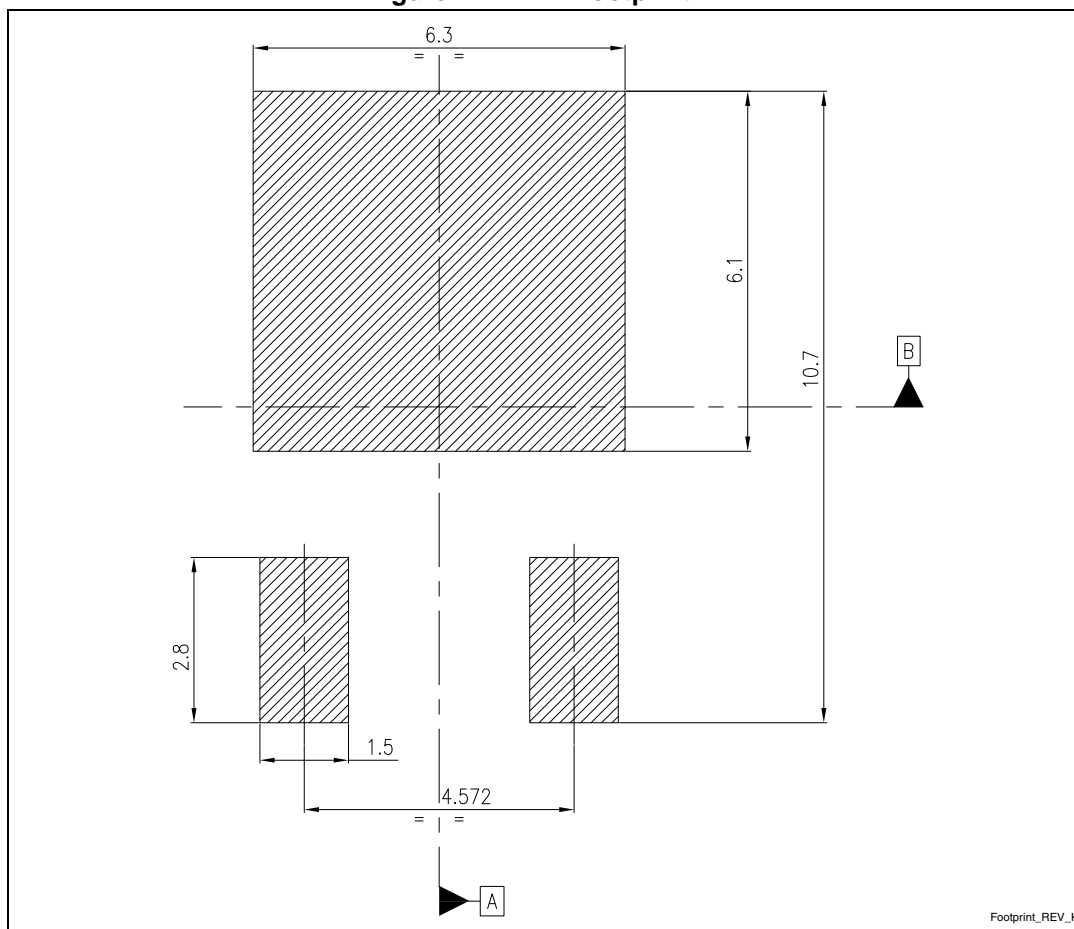


Figure 24. DPAK footprint (a)

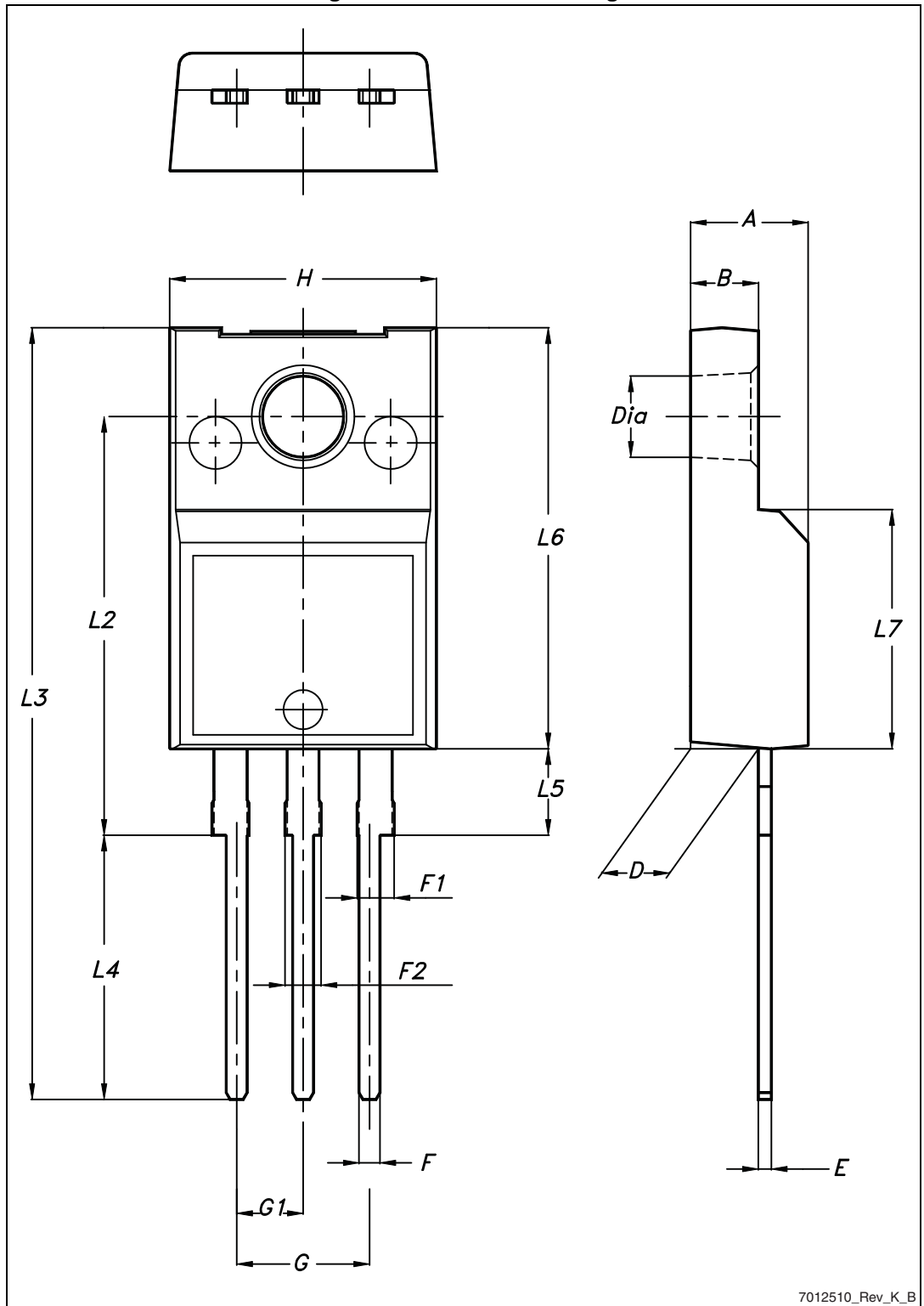


a. All dimensions are in millimeters

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



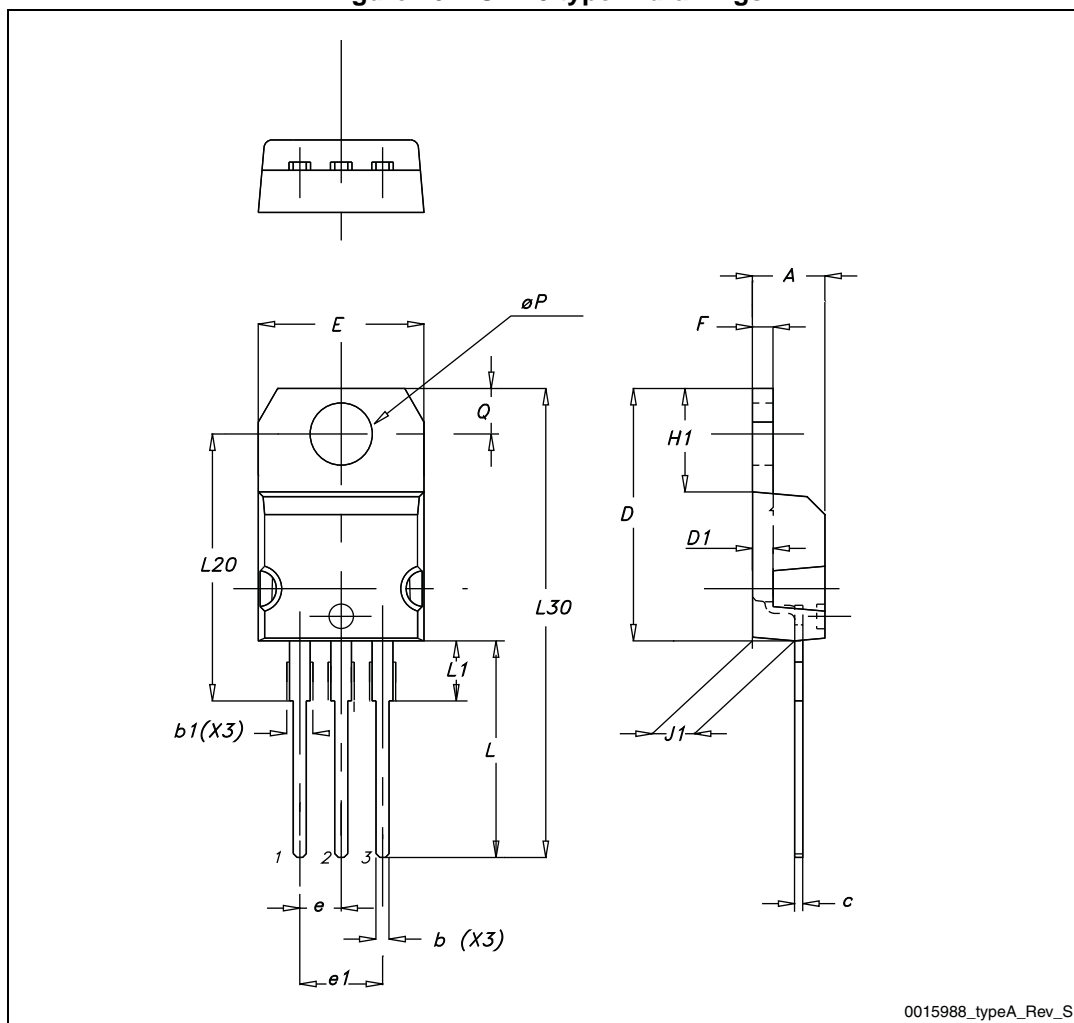
7012510\_Rev\_K\_B

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)

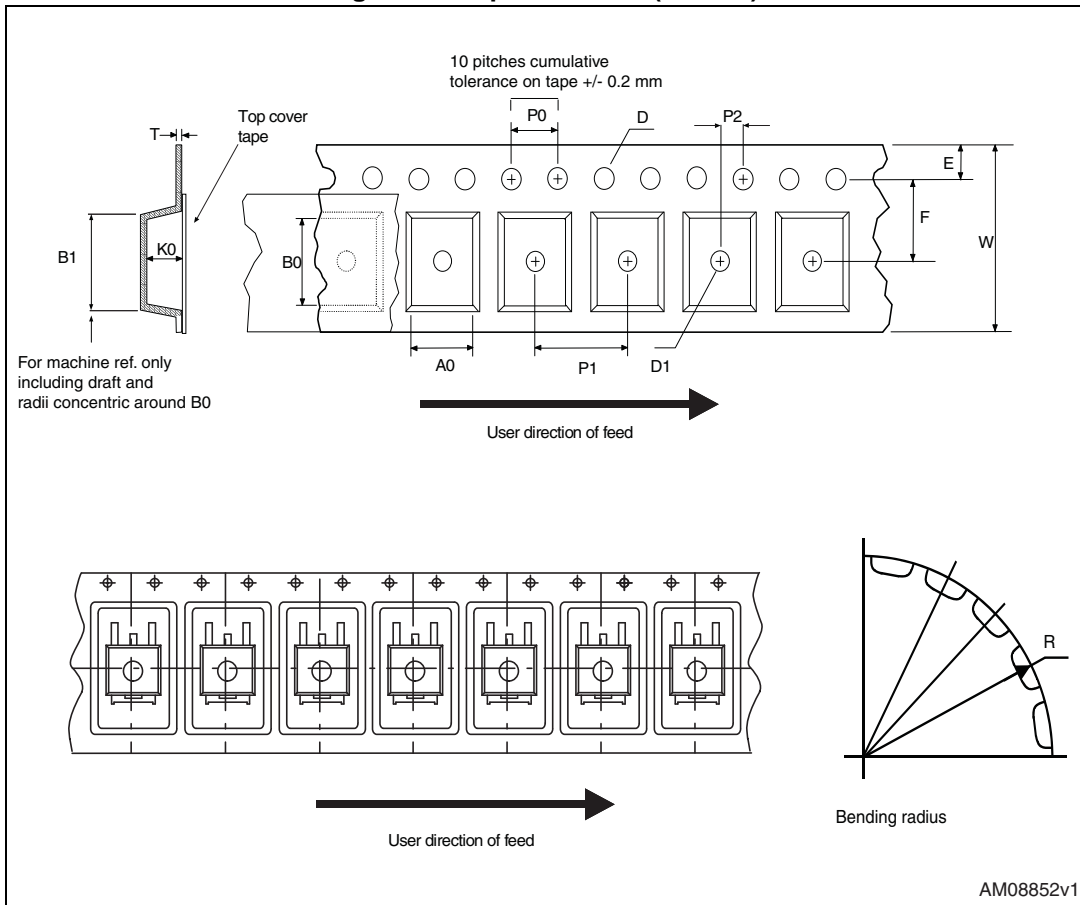
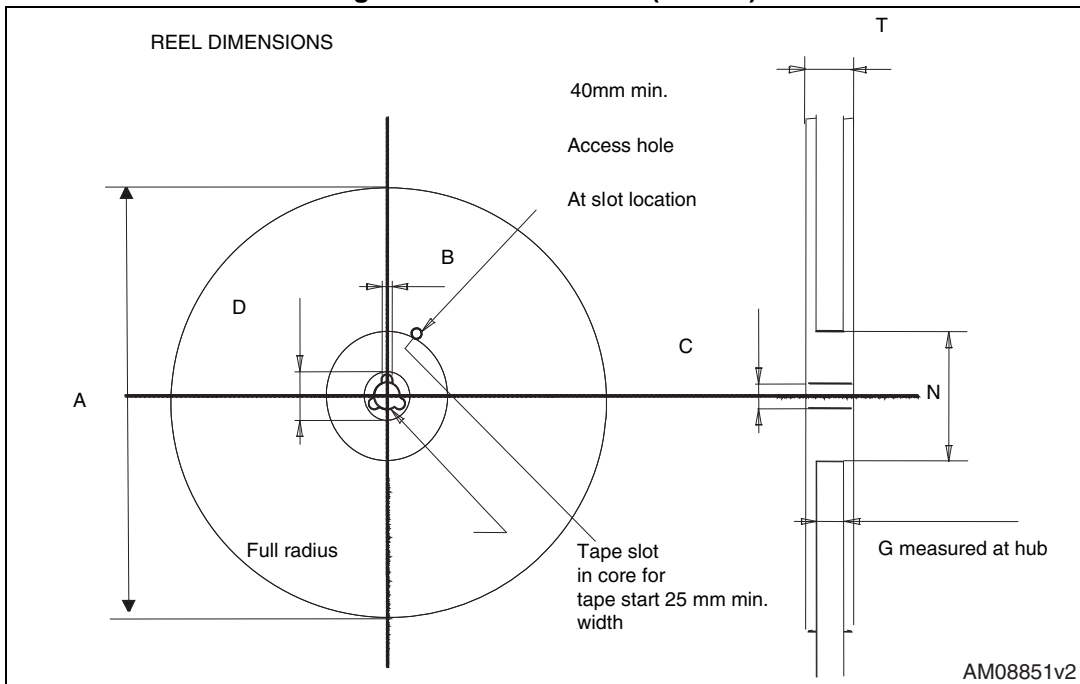


Figure 28. Reel for DPAK (TO-252)



## 6 Revision history

Table 12. Document revision history

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

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