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STD17NF25, STF17NF25, STP17NF25

N-channel 250 V 0.14 Ω typ., 17 A low gate charge STripFET™ II
Power MOSFET in DPAK, TO-220FP and TO-220 packages

Datasheet — production data

Features

Order codes	V _{DSS}	R _{DS(on)} max.	I _D	P _{TOT}
STD17NF25	250V	< 0.165 Ω	17A	90W
STF17NF25	250V	< 0.165 Ω	17A	25W
STP17NF25	250V	< 0.165 Ω	17A	90W

- Low gate charge
- 100% avalanche tested
- Exceptional dv/dt capability

Application

- Switching applications

Description

These Power MOSFETs have been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the devices suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

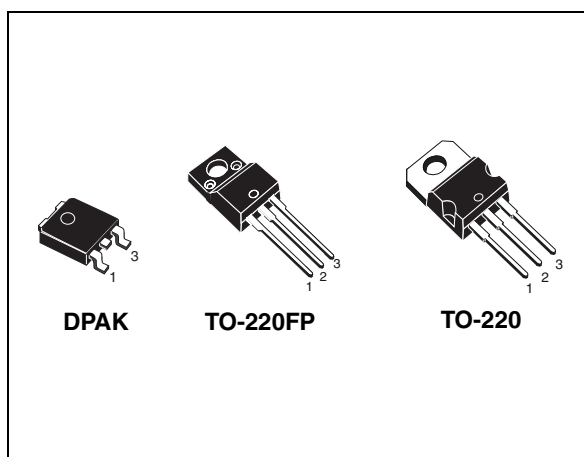


Figure 1. Internal schematic diagram

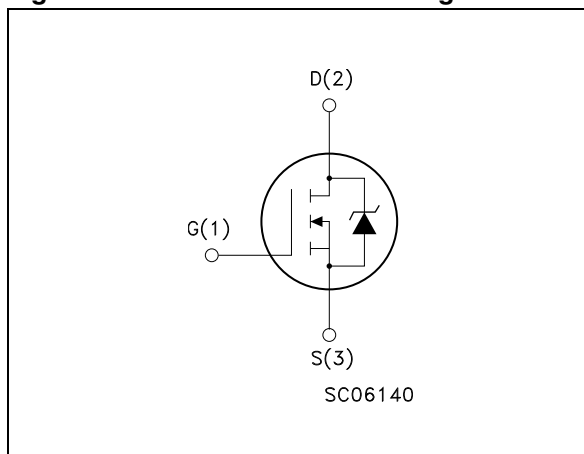


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD17NF25	17NF25	DPAK	Tape and reel
STF17NF25		TO-220FP	Tube
STP17NF25		TO-220	

Contents

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Electrical ratings

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220, DPAK	TO-220FP	
V_{DS}	Drain-source voltage	250		V
V_{GS}	Gate-source voltage	± 20		V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	17	17 ⁽¹⁾	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	10	10 ⁽¹⁾	A
$I_{DM}^{(2)}$	Drain current (pulsed)	68	68 ⁽¹⁾	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	90	25	W
	Derating factor	0.72	0.2	W/ $^{\circ}\text{C}$
$dv/dt^{(3)}$	Peak diode recovery voltage slope	10		V/ns
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 150		$^{\circ}\text{C}$

1. Limited only by maximum temperature allowed
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 17\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq 80\%V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	DPAK	TO-220FP	TO-220	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.38	5	1.38	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	50 ⁽¹⁾	62.5	62.5	$^{\circ}\text{C}/\text{W}$

1. When mounted on 1inch² FR-4, 2 Oz copper board

Table 4. Avalanche data

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	17	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	100	mJ

Electrical characteristics

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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	I _D = 1mA, V _{GS} = 0	250			V
I _{DSS}	Zero gate voltage drain current (V _{GS} = 0)	V _{DS} = 250 V, V _{DS} = 250 V, T _c = 125 °C			1 10	μA μA
I _{GSS}	Gate body leakage current (V _{DS} = 0)	V _{GS} = ±20V			±100	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static drain-source on resistance	V _{GS} = 10 V, I _D = 8.5 A		0.14	0.165	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss} C _{oss} C _{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V _{DS} = 25 V, f = 1 MHz, V _{GS} = 0	-	1000 178 28	-	pF pF pF
C _{oss eq}	Equivalent output capacitance	V _{GS} = 0, V _{DS} = 0 to 200 V	-	135	-	pF
Q _g Q _{gs} Q _{gd}	Total gate charge Gate-source charge Gate-drain charge	V _{DD} = 200 V, I _D = 17 A V _{GS} = 10 V (see Figure 17)	-	29.5 4.8 15.6	-	nC nC nC
R _G	Gate input resistance	f = 1 MHz gate DC bias = 0 test signal level = 20 mV open drain	-	2	-	Ω

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Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD}=125\text{ V}$, $I_D=8.5\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=10\text{ V}$ (see Figure 16)	-	8.8	-	ns
t_r	Rise time			17.2		ns
$t_{d(off)}$	Turn-off delay time	$V_{DD}=125\text{ V}$, $I_D=8.5\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=10\text{ V}$ (see Figure 16)	-	21	-	ns
t_f	Fall time			8.8		ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		17	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				68	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=17\text{ A}$, $V_{GS}=0$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 17\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 50\text{ V}$ (see Figure 18)	-	157		ns
Q_{rr}	Reverse recovery charge			0.91		μC
I_{RRM}	Reverse recovery current			11.6		A
t_{rr}	Reverse recovery time	$I_{SD} = 17\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 50\text{ V}$, $T_j=150\text{ }^\circ\text{C}$ (see Figure 18)	-	196		ns
Q_{rr}	Reverse recovery charge			1.34		μC
I_{RRM}	Reverse recovery current			13.7		A

1. Pulse width limited by safe operating area

2. Pulsed: pulse duration=300 μs , duty cycle 1.5%

Electrical characteristics

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2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220, DPAK

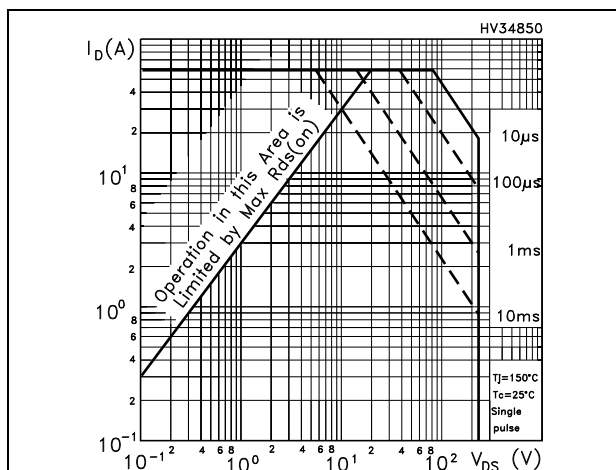


Figure 3. Thermal impedance for TO-220, DPAK

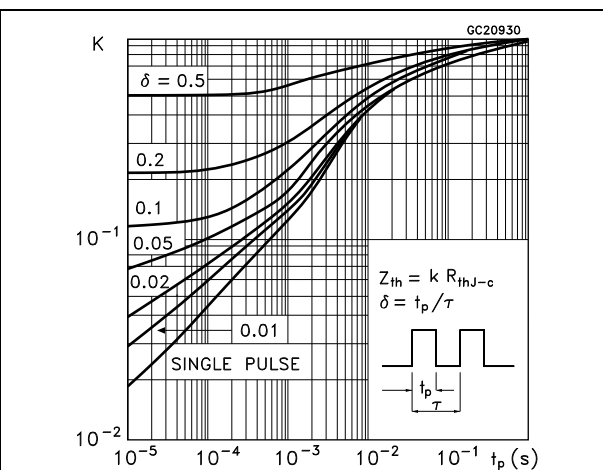


Figure 4. Safe operating area for TO-220FP

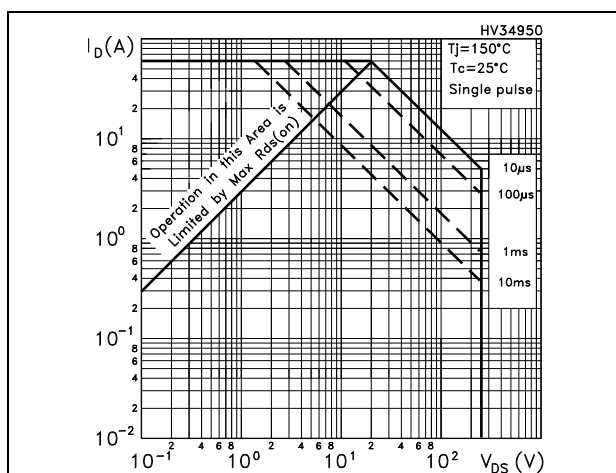


Figure 5. Thermal impedance for TO-220FP

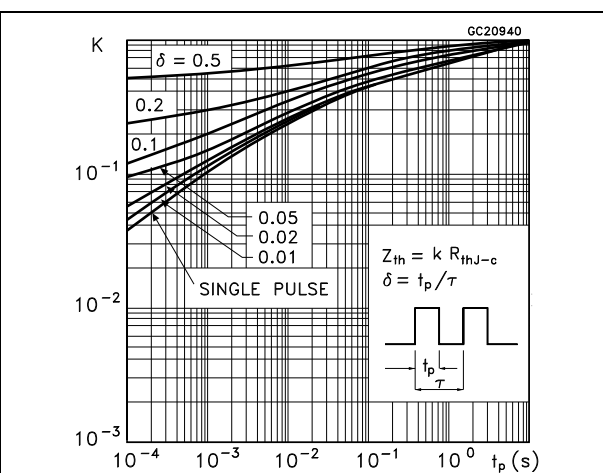


Figure 6. Output characteristics

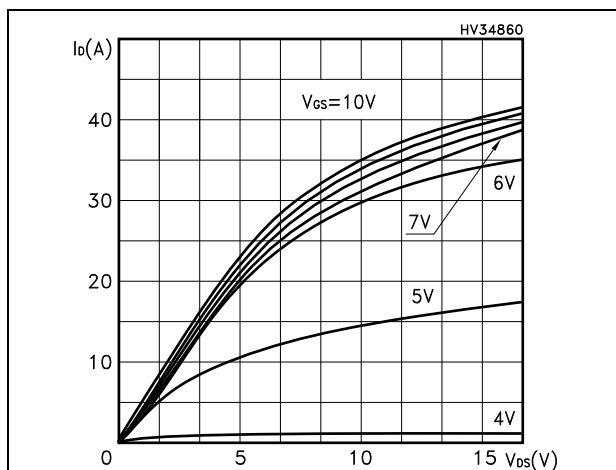
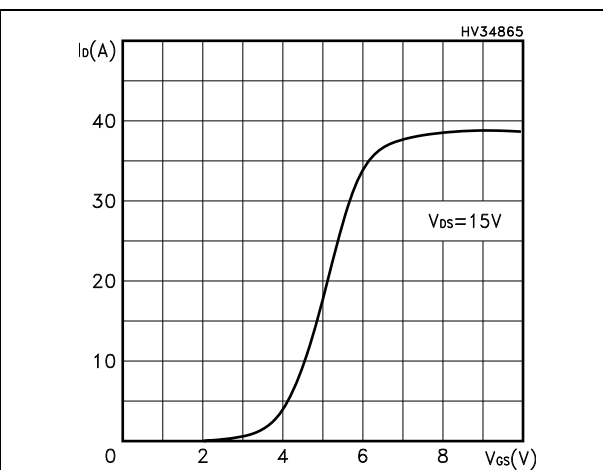


Figure 7. Transfer characteristics



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Electrical characteristics

Figure 8. Normalized BV_{DSS} vs temperature

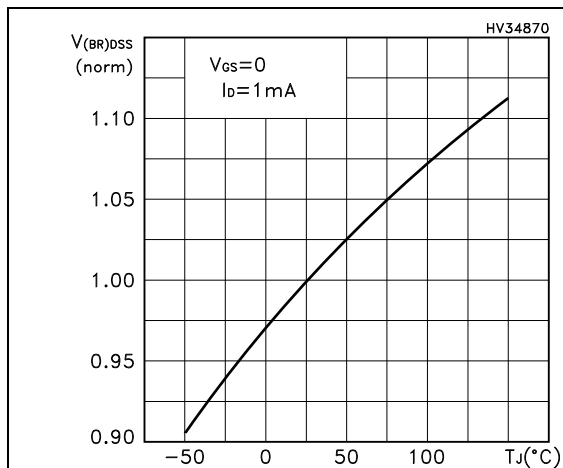


Figure 9. Static drain-source on resistance

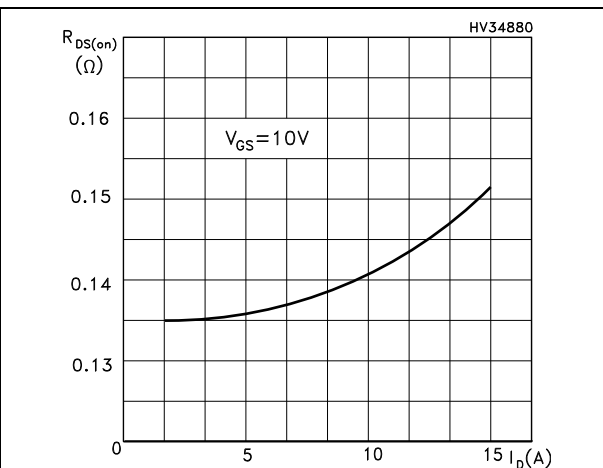


Figure 10. Gate charge vs gate-source voltage

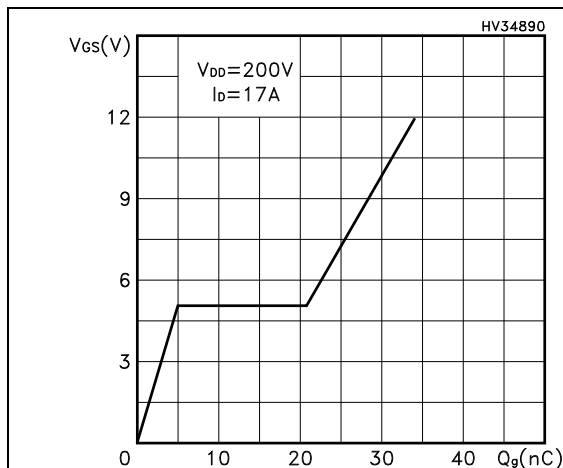


Figure 11. Capacitance variations

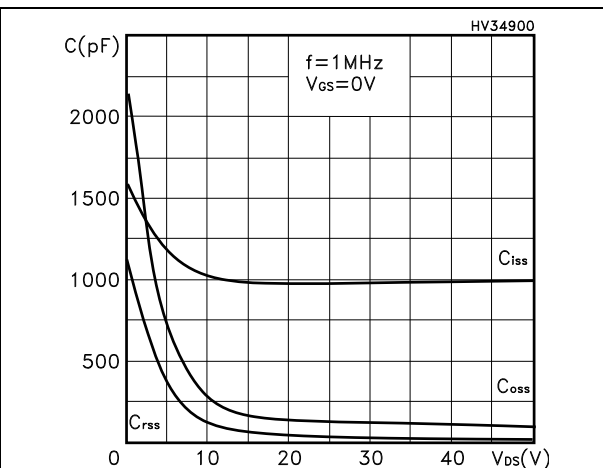


Figure 12. Normalized gate threshold voltage vs temperature

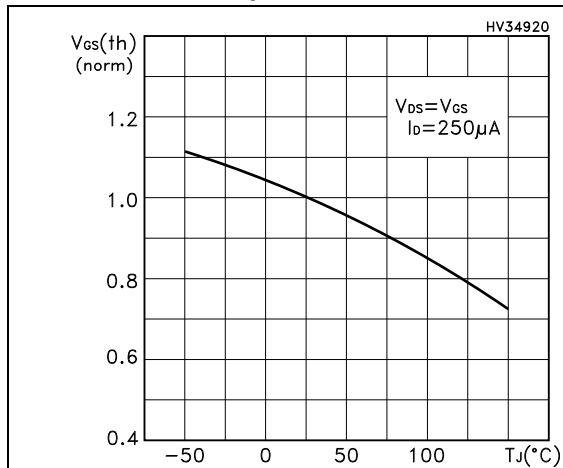
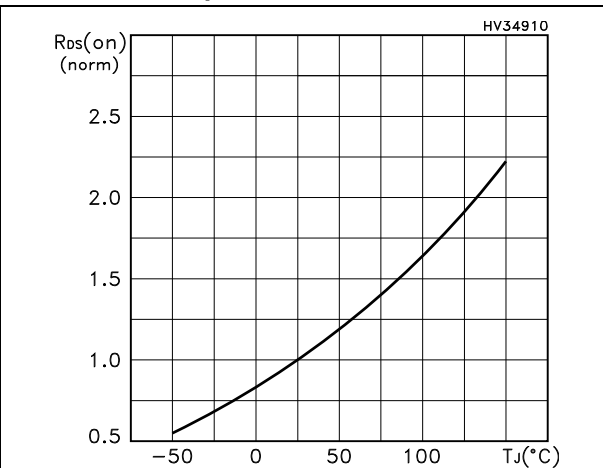


Figure 13. Normalized on resistance vs temperature



Electrical characteristics

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Figure 14. Source-drain diode forward characteristics

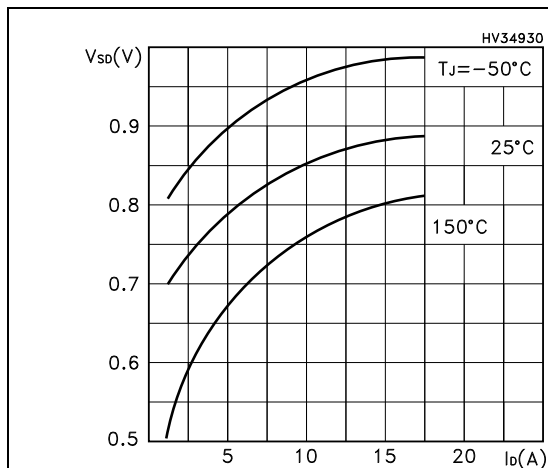
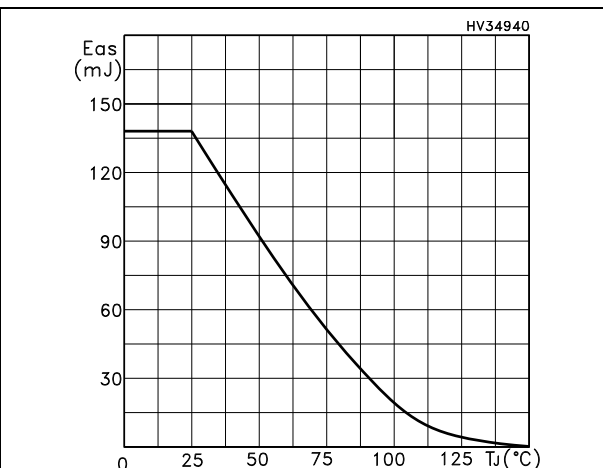


Figure 15. Maximum avalanche energy



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Test circuits

3 Test circuits

Figure 16. Switching times test circuit for resistive load

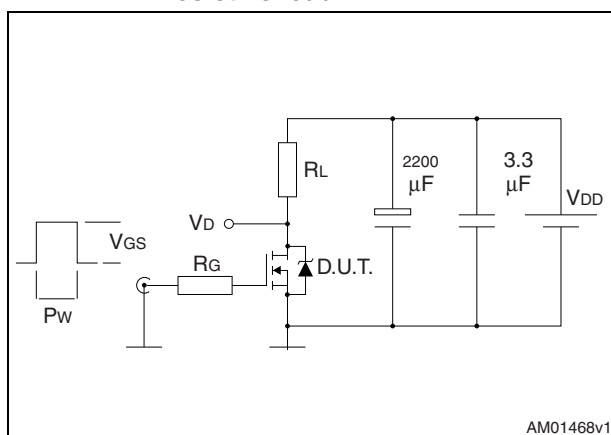


Figure 17. Gate charge test circuit

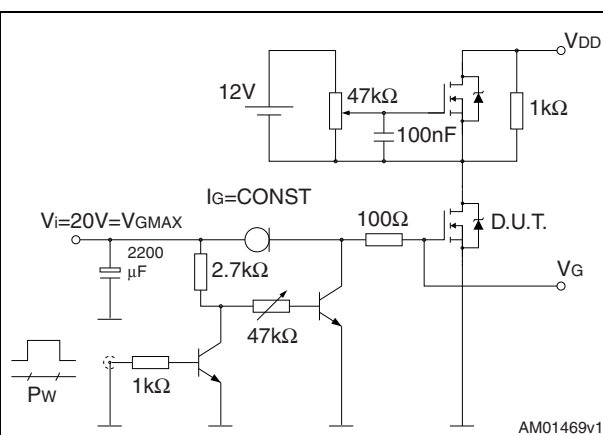


Figure 18. Test circuit for inductive load switching and diode recovery times

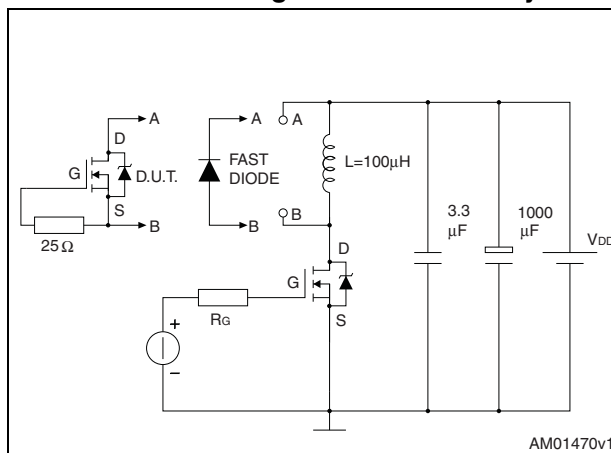


Figure 19. Unclamped Inductive load test circuit

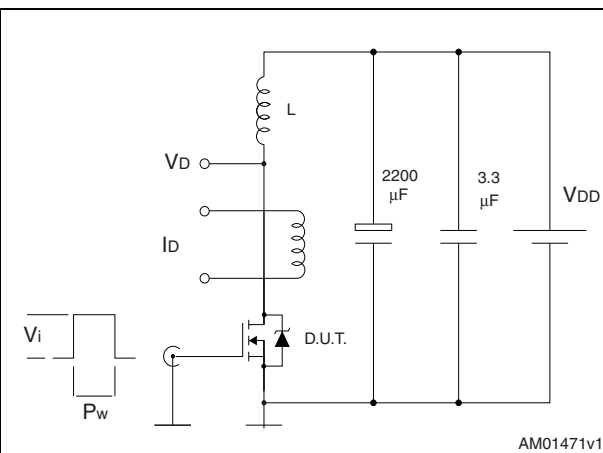


Figure 20. Unclamped inductive waveform

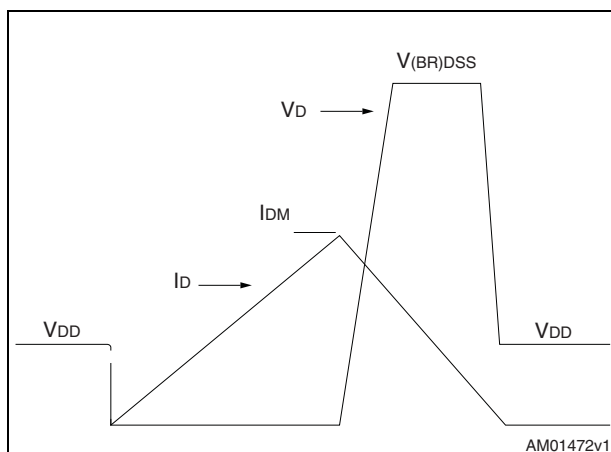
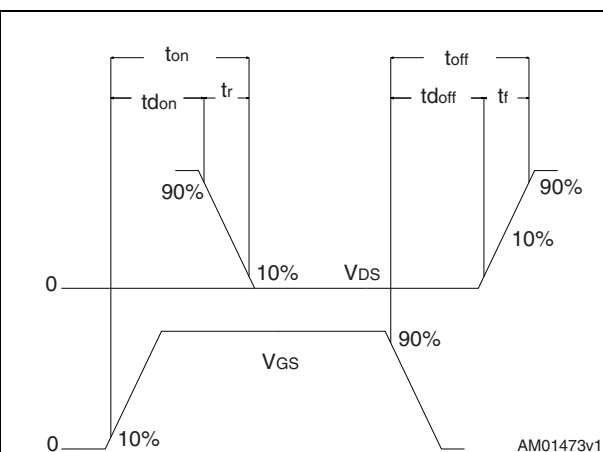


Figure 21. Switching time waveform



Package mechanical data

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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 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		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°

STD17NF25, STF17NF25, STP17NF25

Package mechanical data

Figure 22. DPAK (TO-252) drawing

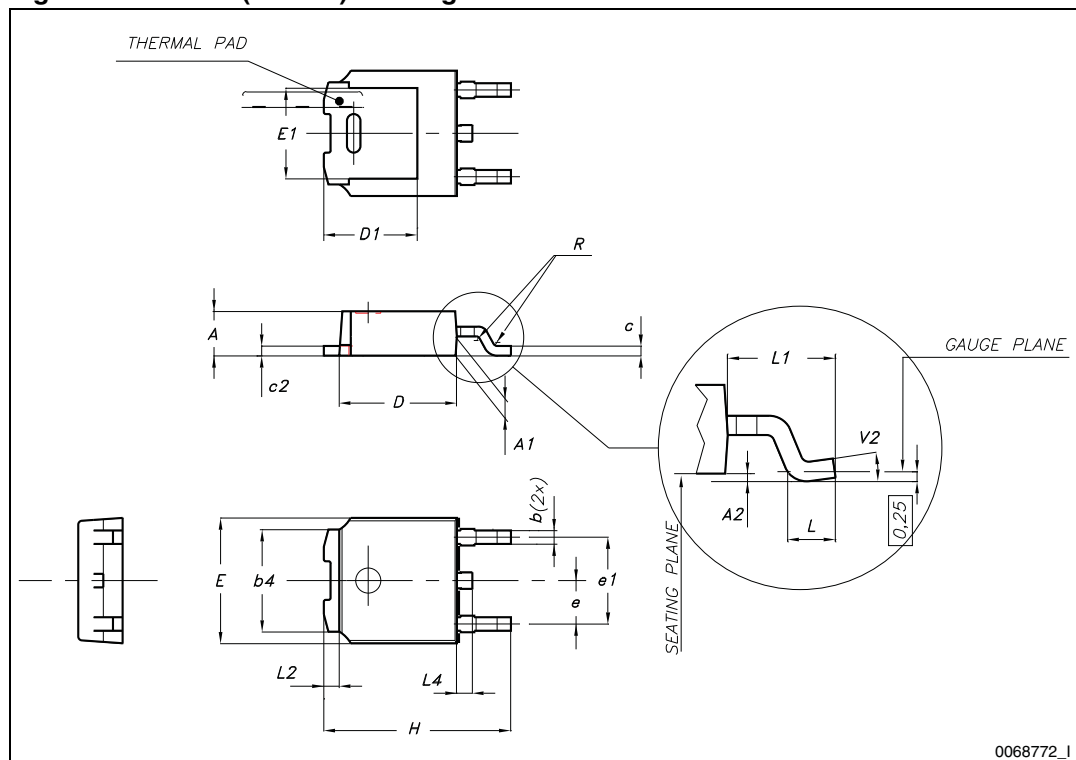
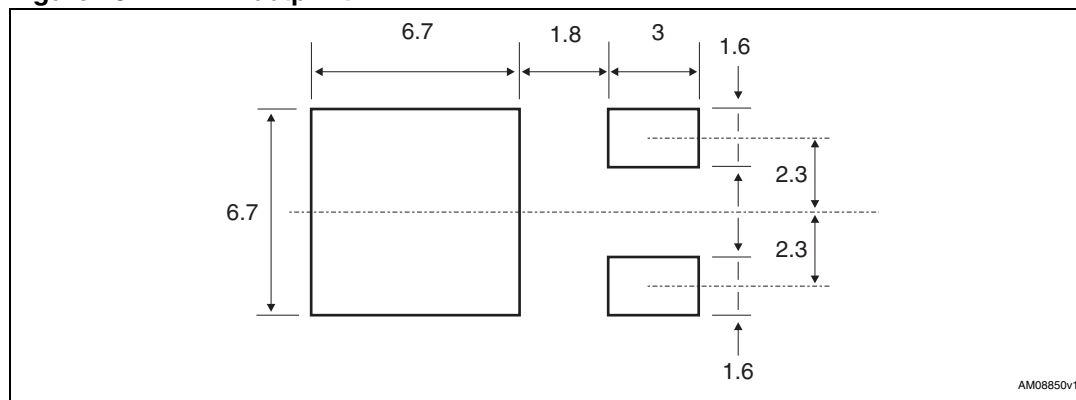


Figure 23. DPAK footprint^(a)



a. All dimensions are in millimeters.

Package mechanical data

STD17NF25, STF17NF25, STP17NF25

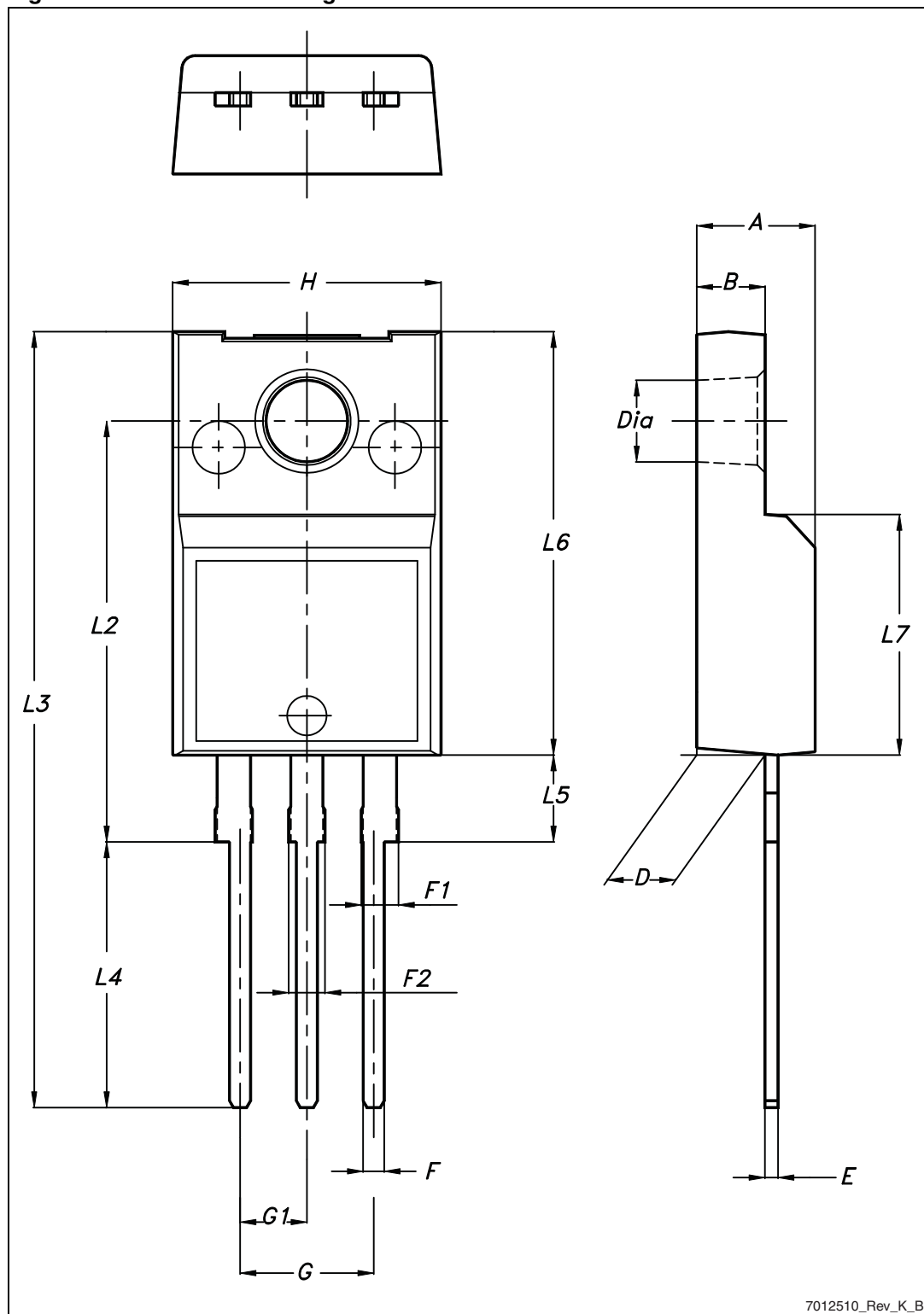
Table 10. TO-220FP mechanical data

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

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Package mechanical data

Figure 24. TO-220FP drawing



7012510_Rev_K_B

Package mechanical data

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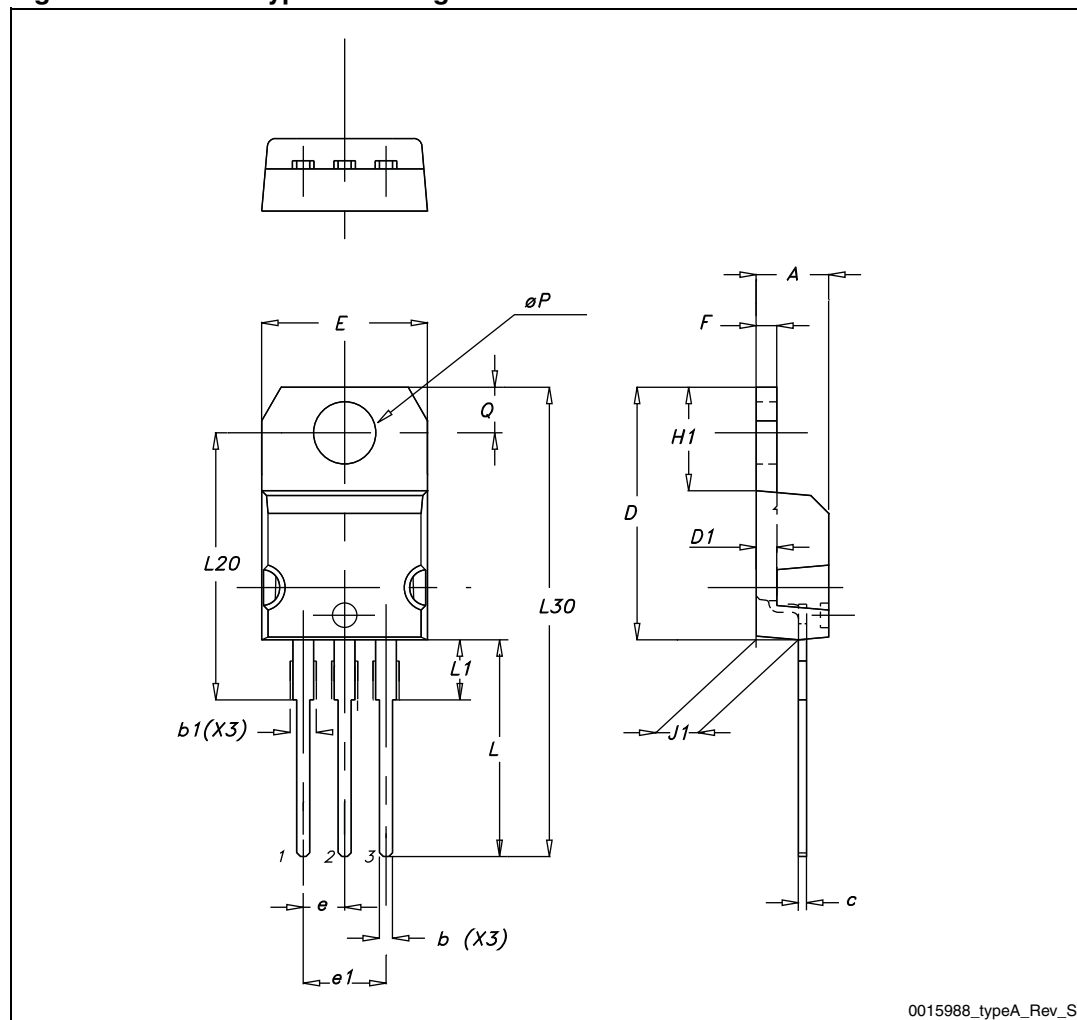
Table 11. TO-220 type A mechanical data

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

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Package mechanical data

Figure 25. TO-220 type A drawing



Packaging mechanical data

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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			

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Packaging mechanical data

Figure 26. Tape for DPAK (TO-252)

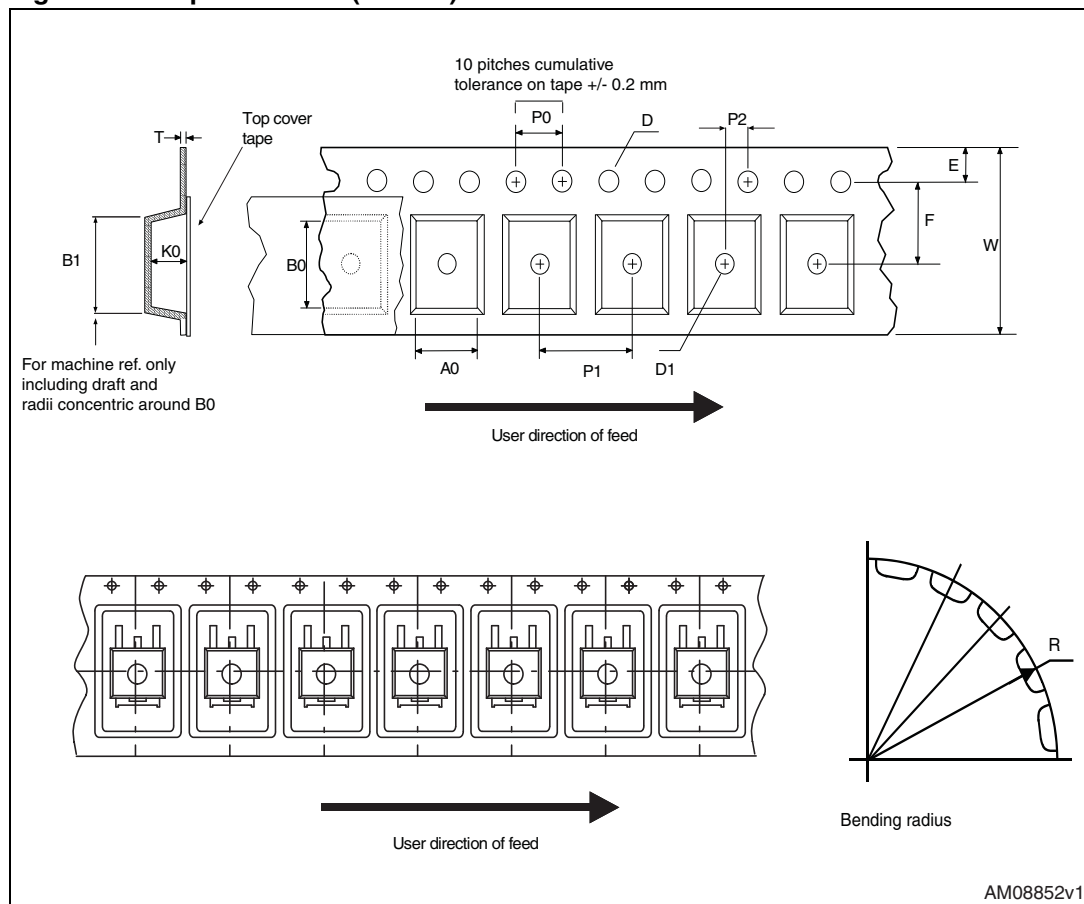
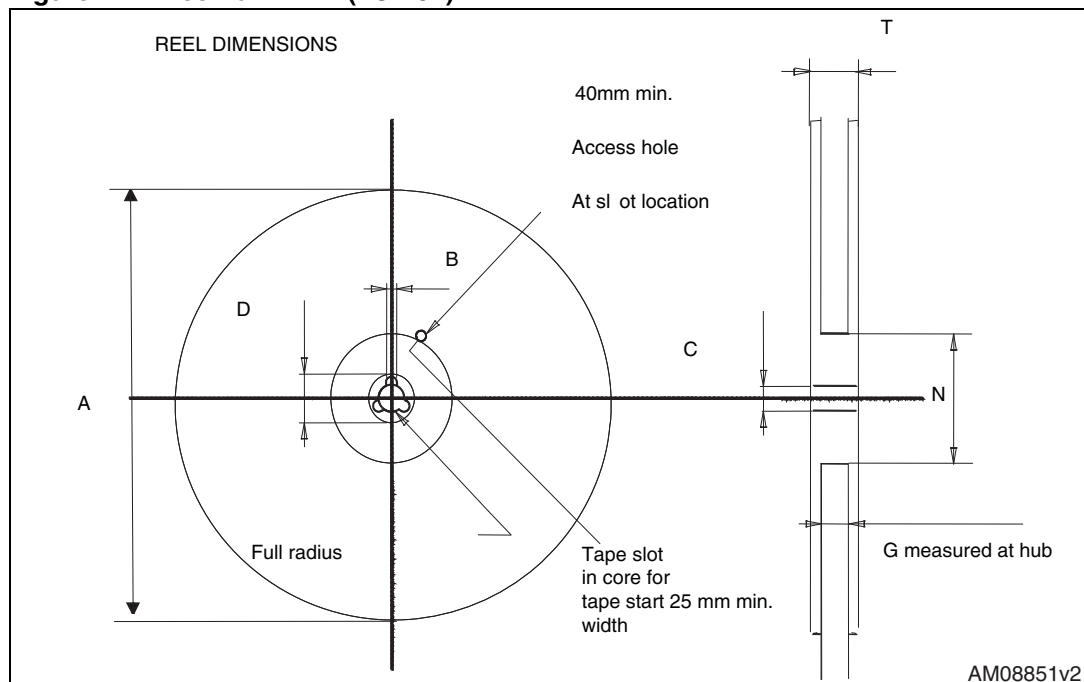


Figure 27. Reel for DPAK (TO-252)



Revision history

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6 Revision history

Table 13. Document revision history

Date	Revision	Changes
01-Feb-2007	1	First release.
07-Nov-2012	2	Minor text changes. The part number STI17NF25 has been moved to a separate datasheet. Section 4: Package mechanical data and Section 5: Packaging mechanical data have been updated.

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