



# STB19NF20, STF19NF20, STP19NF20

N-channel 200 V, 0.15Ω typ., 15 A MESH OVERLAY™  
Power MOSFET in D<sup>2</sup>PAK, TO-220FP and TO-220 packages

Datasheet — production data

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>	P <sub>w</sub>
STB19NF20	200V	<0.16Ω	15A	90W
STF19NF20	200V	<0.16Ω	15A	25W
STP19NF20	200V	<0.16Ω	15A	90W

- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitances

## Applications

- Switching application

## Description

This Power MOSFET is designed using the company's consolidated strip layout-based MESH OVERLAY™ process. The result is a product that matches or improves on the performance of comparable standard parts from other manufacturers.

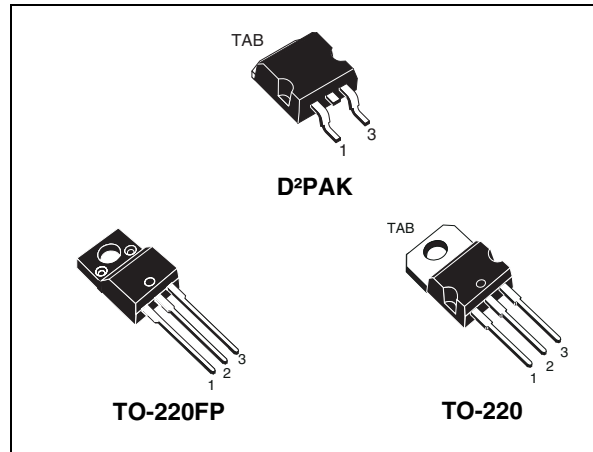
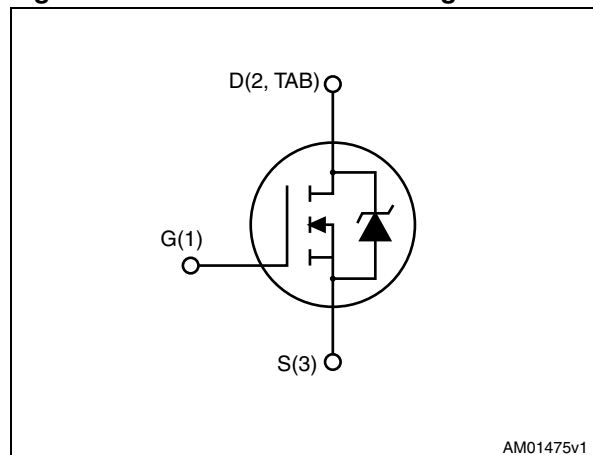


Figure 1. Internal schematic diagram



AM01475v1

Table 1. Device summary

Order codes	Marking	Package	Packaging
STB19NF20	19NF20	D <sup>2</sup> PAK	Tape and reel
STF19NF20	19NF20	TO-220FP	Tube
STP19NF20	19NF20	TO-220	

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		TO-220/D <sup>2</sup> PAK	TO-220FP	
V <sub>DS</sub>	Drain-source voltage	200		V
V <sub>GS</sub>	Gate-source voltage	± 20		V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25°C	15	15 <sup>(1)</sup>	A
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> =100°C	9.45	9.45 <sup>(1)</sup>	A
I <sub>DM</sub> <sup>(2)</sup>	Drain current (pulsed)	60	60 <sup>(1)</sup>	A
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25°C	90	25	W
	Derating factor	0.72	0.2	W/°C
V <sub>ISO</sub>	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1s;T <sub>C</sub> =25°C)	--	2500	V
dv/dt <sup>(3)</sup>	Peak diode recovery voltage slope	15		V/ns
T <sub>J</sub> T <sub>stg</sub>	Operating junction temperature Storage temperature	-55 to 150		°C

- Limited by package
- Pulse width limited by safe operating area
- I<sub>SD</sub> ≤ 15A, di/dt ≤ 300A/μs, V<sub>DD</sub> = 80%V<sub>(BR)DSS</sub>

**Table 3. Thermal data**

Symbol	Parameter	Value			Unit
		TO-220	D <sup>2</sup> PAK	TO-220FP	
R <sub>thj-case</sub>	Thermal resistance junction-case max	1.39		5	°C/W
R <sub>thj-pcb</sub>	Thermal resistance junction-pcb max	--	50	--	
R <sub>thj-a</sub>	Thermal resistance junction-ambient max	62.5			°C/W
T <sub>l</sub>	Maximum lead temperature for soldering purpose	300			°C

**Table 4. Avalanche data**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by Tj Max)	15	A
$E_{AS}$	Single pulse avalanche energy (starting Tj=25°C, Id=Iar, Vdd=50V)	110	mJ

## 2 Electrical characteristics

( $T_{CASE}=25^{\circ}C$  unless otherwise specified).

**Table 5. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1mA, V_{GS} = 0$	200			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 200V$ $V_{DS} = 200V, T_C = 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10V, I_D = 7.5A$		0.15	0.16	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 8V, I_D = 7.5A$		12		S
$C_{iss}$	Input capacitance	$V_{DS} = 25V, f = 1MHz,$ $V_{GS} = 0$		800		pF
$C_{oss}$	Output capacitance			165		pF
$C_{rss}$	Reverse transfer capacitance			26		pF
$Q_g$	Total gate charge	$V_{DD} = 160V, I_D = 15A$		24		nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10V$		4.4		nC
$Q_{gd}$	Gate-drain charge	(see Figure 17)		11.6		nC

1. Pulsed: pulse duration=300 $\mu s$ , duty cycle 1.5%

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 100V, I_D = 7.5A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 16)		11.5		ns
$t_r$	Rise time			22		ns
$t_{d(off)}$	Turn-off delay time	$V_{DD} = 100V, I_D = 7.5A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 16)		19		ns
$t_f$	Fall time			11		ns

**Table 8. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
$I_{SD}$	Source-drain current				15	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				60	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=15A, V_{GS}=0$			1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD}=15A, V_{DD}=50V$		125		ns
$Q_{rr}$	Reverse recovery charge	$di/dt = 100A/\mu s,$		0.55		$\mu C$
$I_{RRM}$	Reverse recovery current	(see Figure 21)		8.8		A
$t_{rr}$	Reverse recovery time	$I_{SD}=15A, V_{DD}=50V$		148		ns
$Q_{rr}$	Reverse recovery charge	$di/dt = 100A/\mu s,$		0.73		$\mu C$
$I_{RRM}$	Reverse recovery current	$T_J=150^\circ C$ (see Figure 21)		9.9		A

1. Pulse width limited by safe operating area.
2. Pulsed: pulse duration = 300 $\mu s$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220 / D<sup>2</sup>PAK

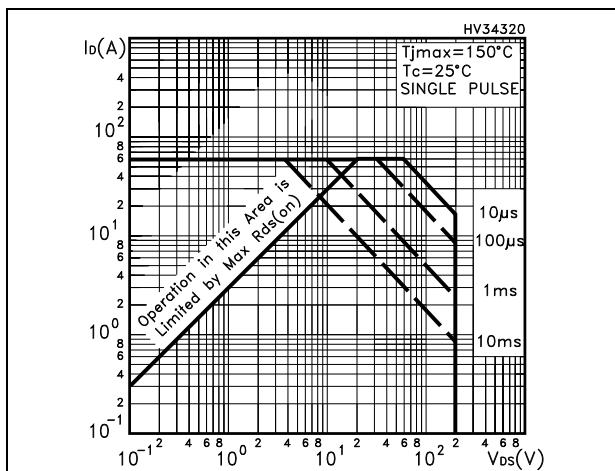


Figure 3. Thermal impedance for TO-220 / D<sup>2</sup>PAK

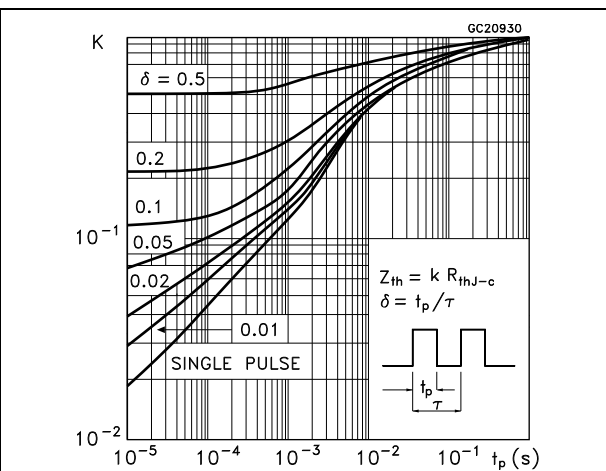


Figure 4. Safe operating area for TO-220FP

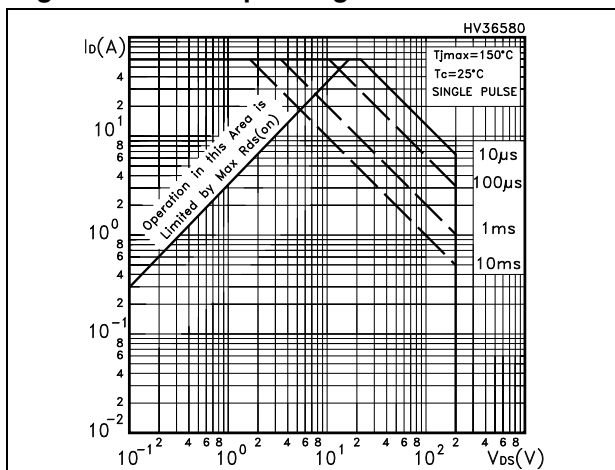


Figure 5. Thermal impedance for TO-220FP

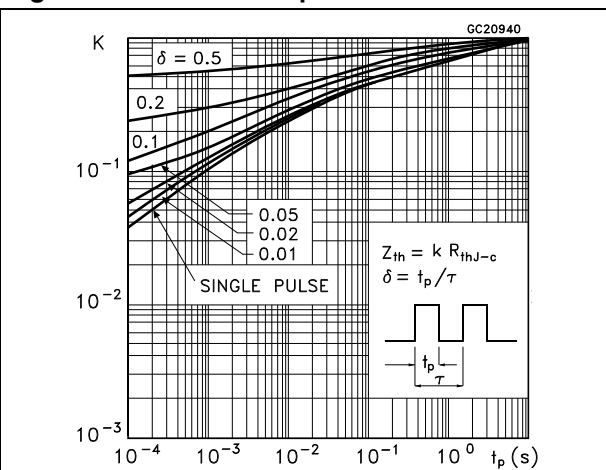


Figure 6. Output characteristics

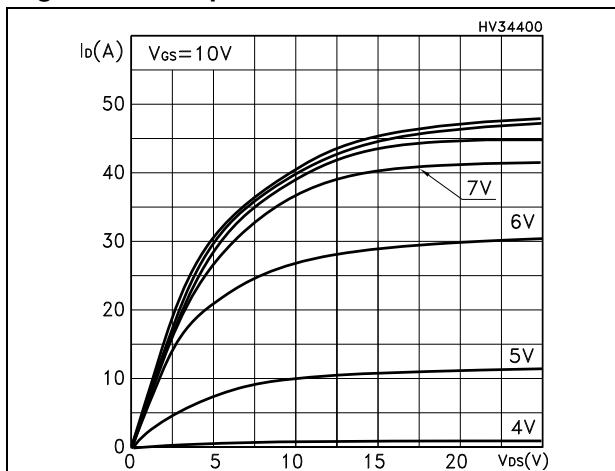


Figure 7. Transfer characteristics

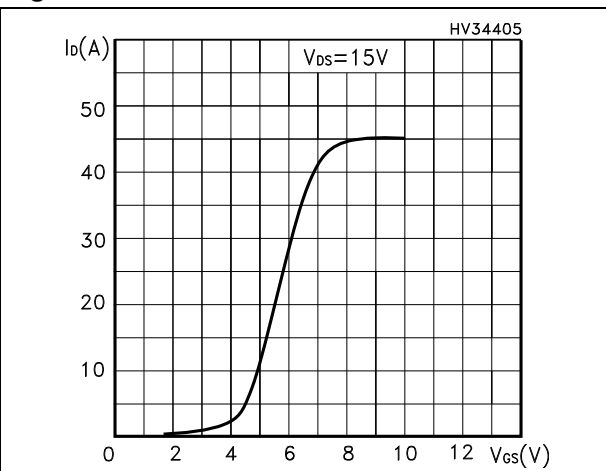


Figure 8. Static drain-source on-resistance

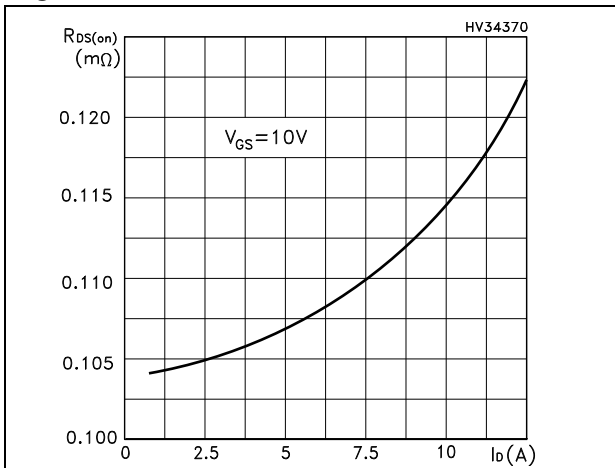


Figure 9. Normalized BV<sub>DSS</sub> vs temperature

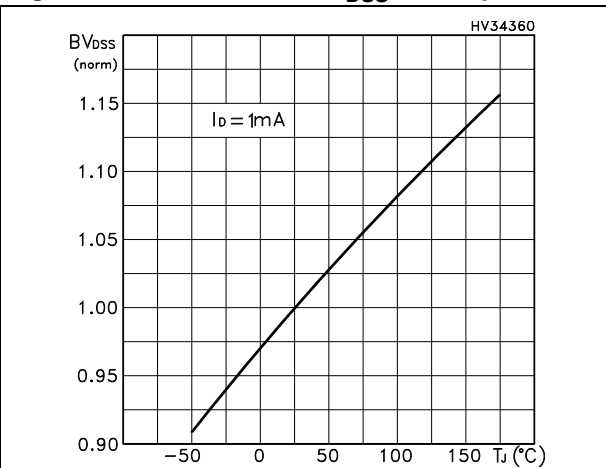


Figure 10. Gate charge vs gate-source voltage

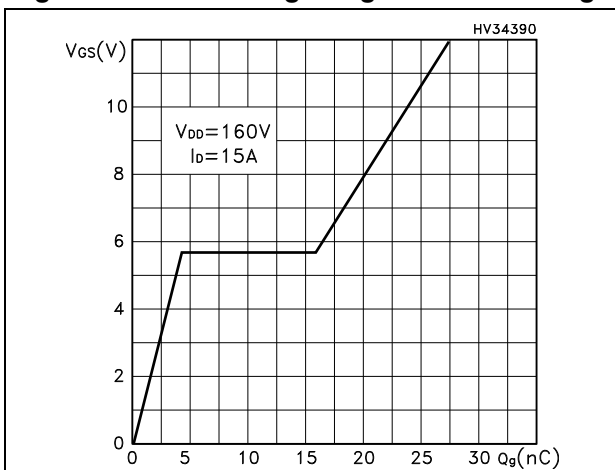


Figure 11. Capacitance variations

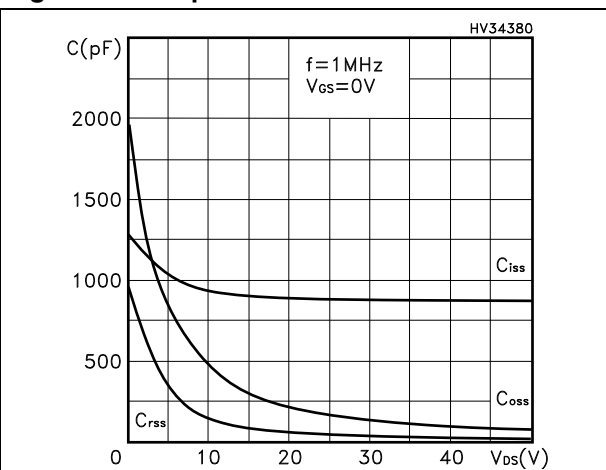


Figure 12. Normalized gate threshold voltage vs temperature

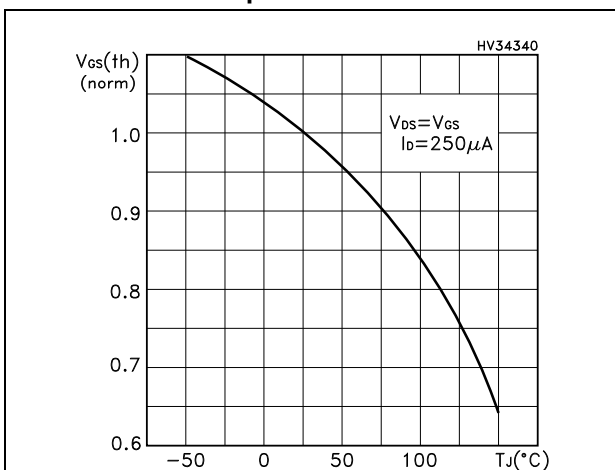


Figure 13. Normalized on resistance vs temperature

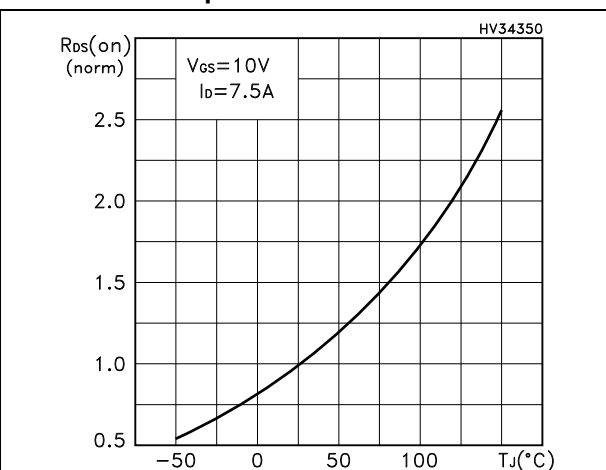




Figure 14. Source-drain forward characteristics

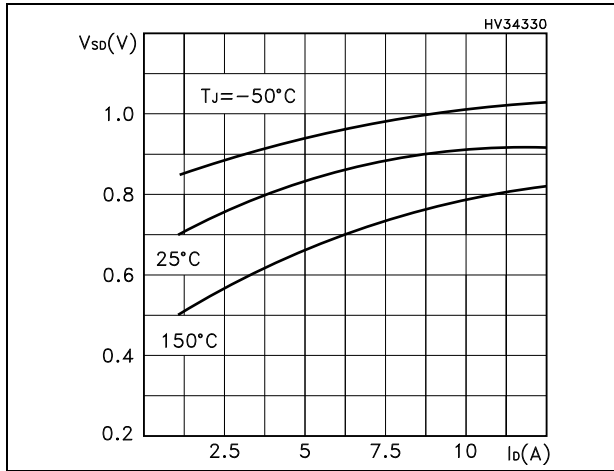
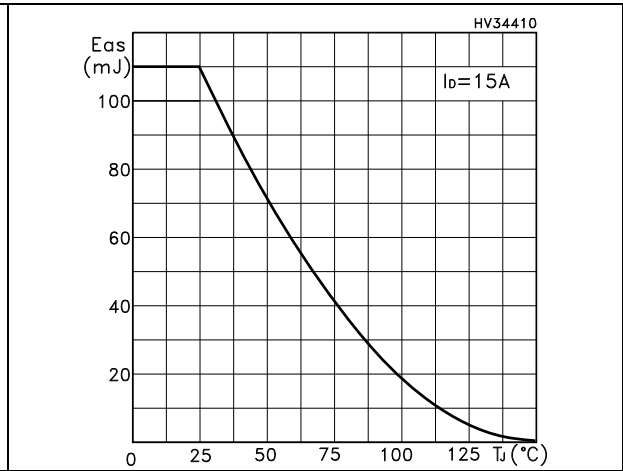


Figure 15. Maximum avalanche energy vs temperature



### 3 Test circuit

Figure 16. Switching times test circuit for resistive load

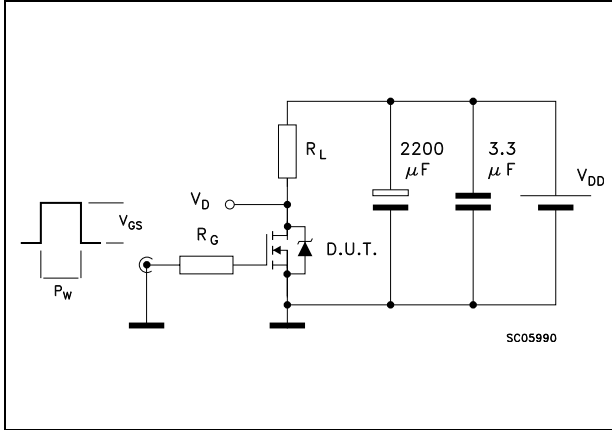


Figure 17. Gate charge test circuit

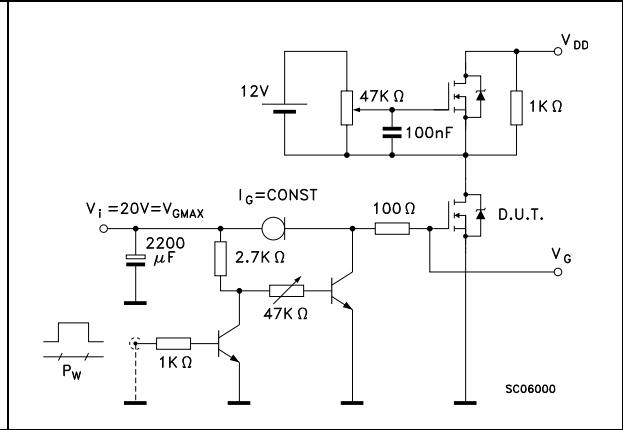


Figure 18. Test circuit for inductive load switching and diode recovery times

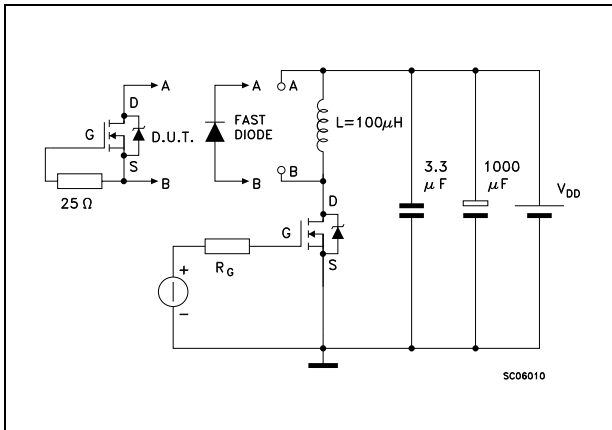


Figure 19. Unclamped Inductive load test circuit

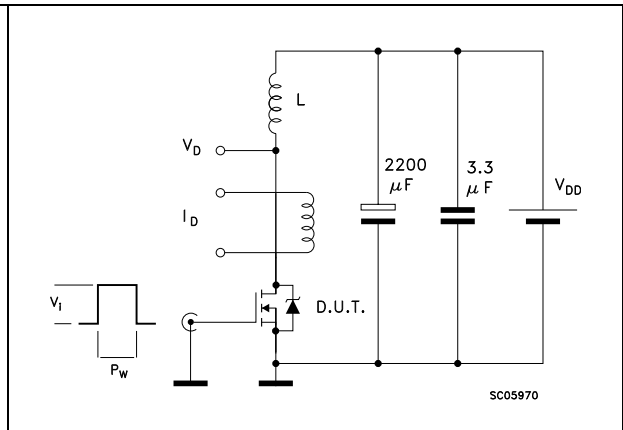


Figure 20. Unclamped inductive waveform

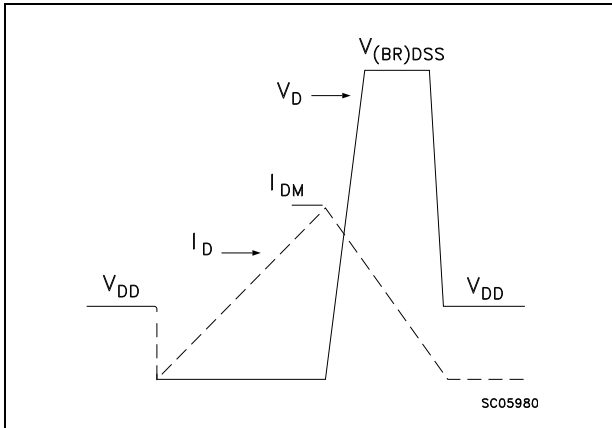
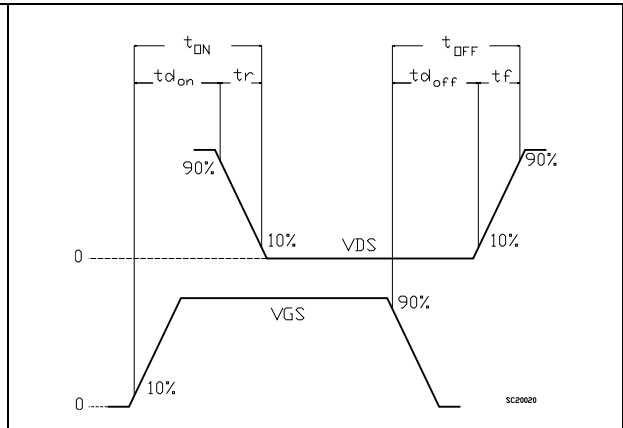


Figure 21. Switching time waveform



## 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. D<sup>2</sup>PAK (TO-263) mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50		
E	10		10.40
E1	8.50		
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 22. D<sup>2</sup>PAK (TO-263) drawing

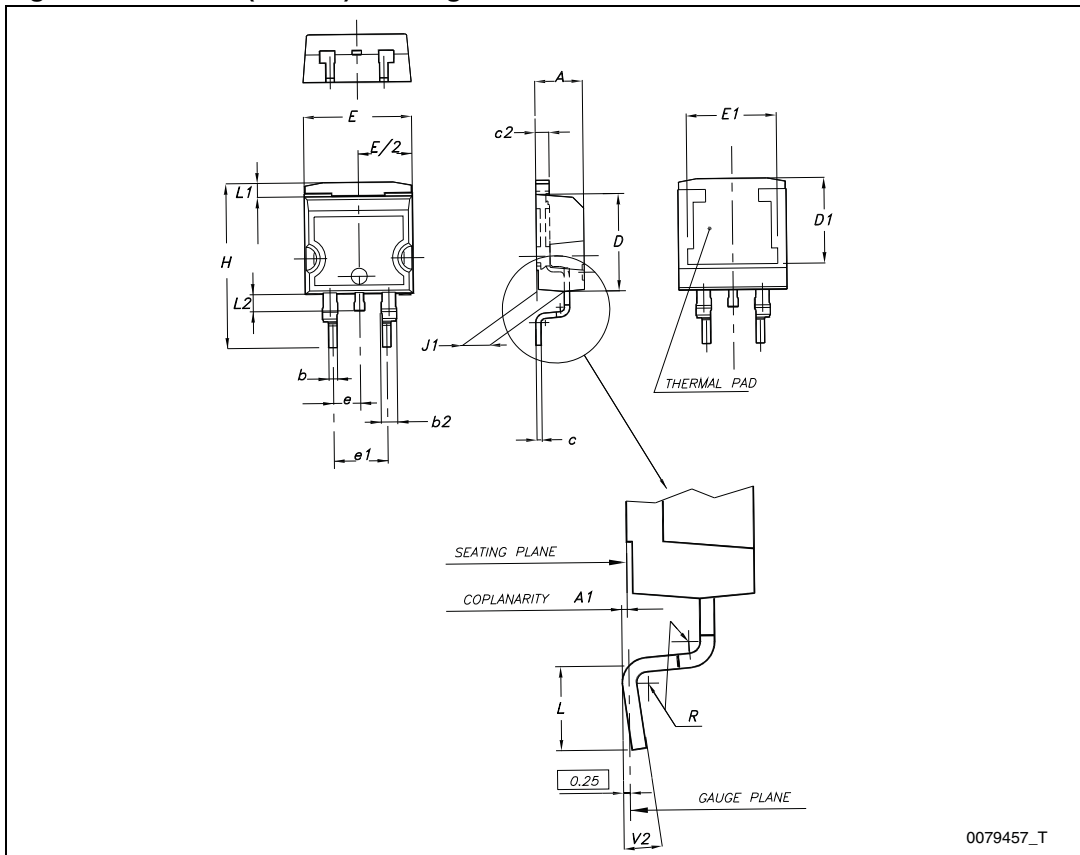
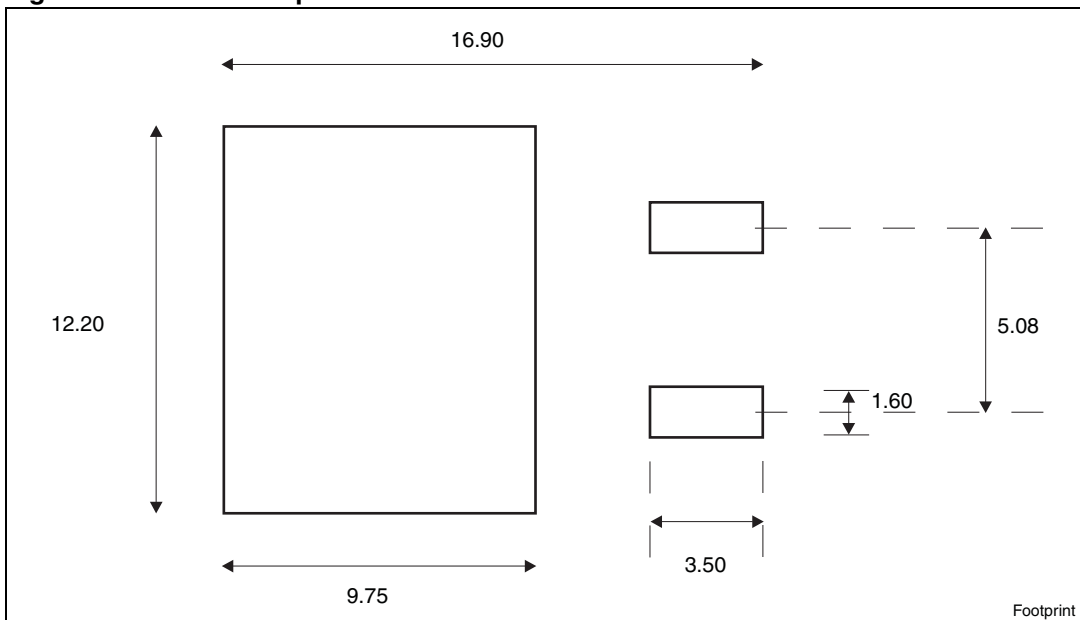


Figure 23. D<sup>2</sup>PAK footprint<sup>(a)</sup>

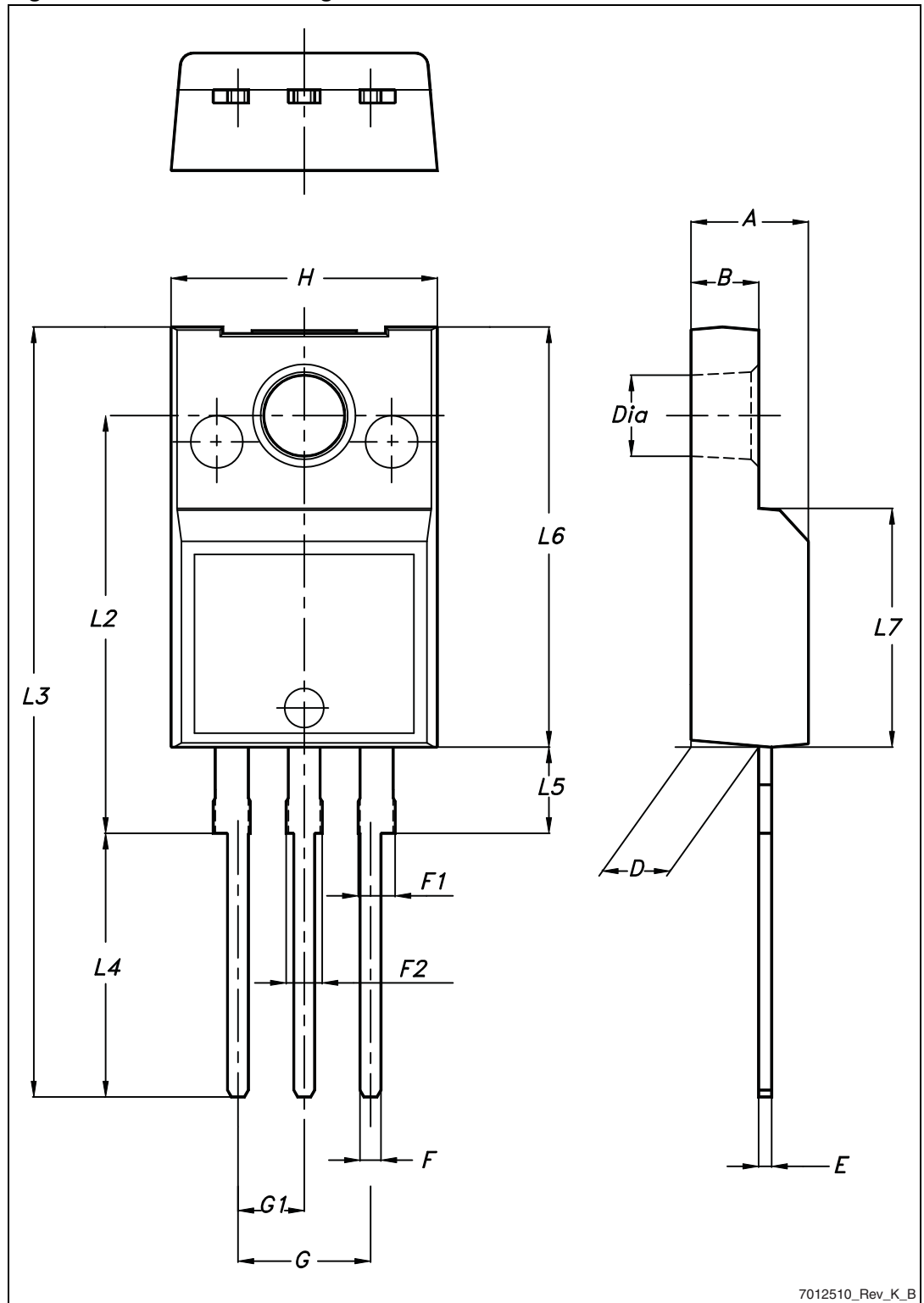


a. All dimension are in millimeters

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 24. TO-220FP drawing

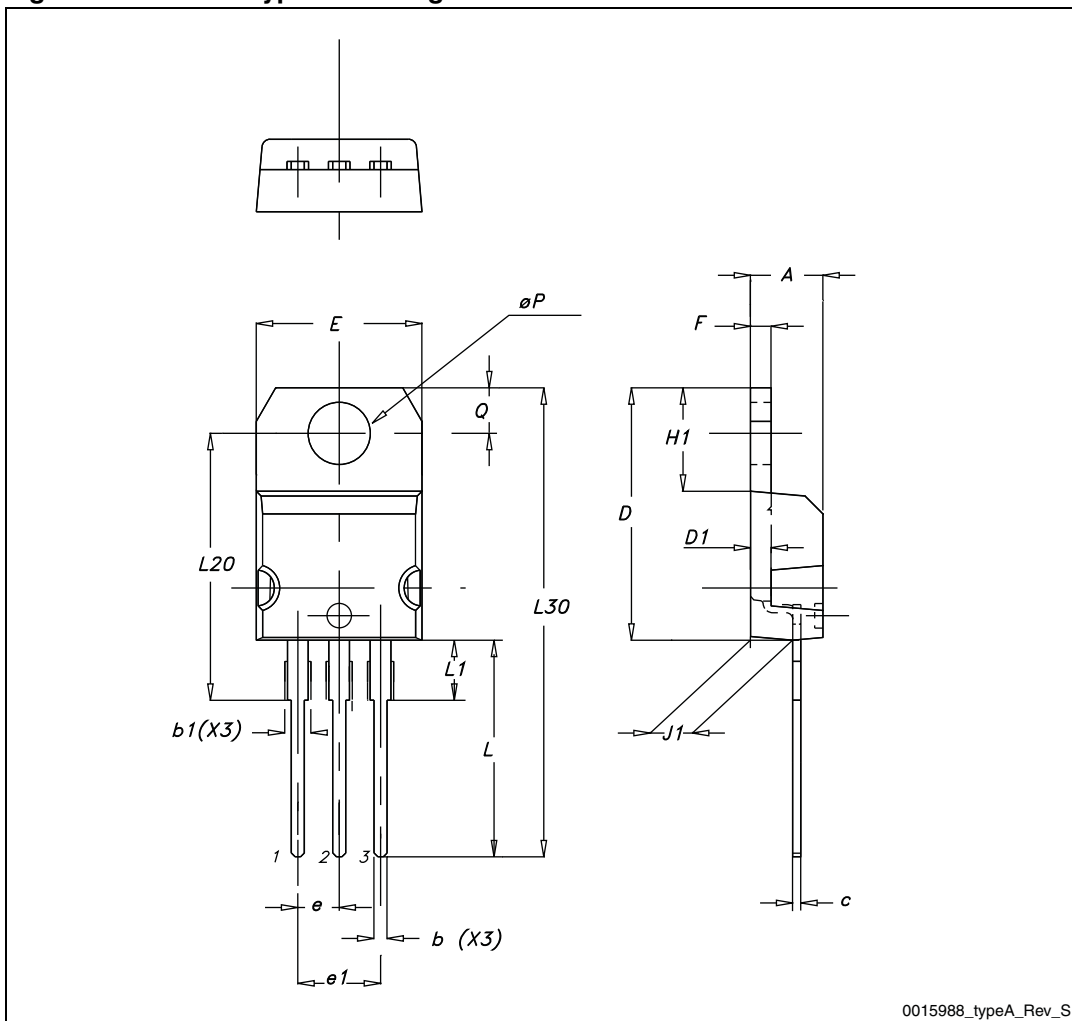


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Table 11. TO-220 type A mechanical data

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

Figure 25. TO-220 type A drawing





## 5 Packaging mechanical data

Table 12. D<sup>2</sup>PAK (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			

Figure 26. Tape

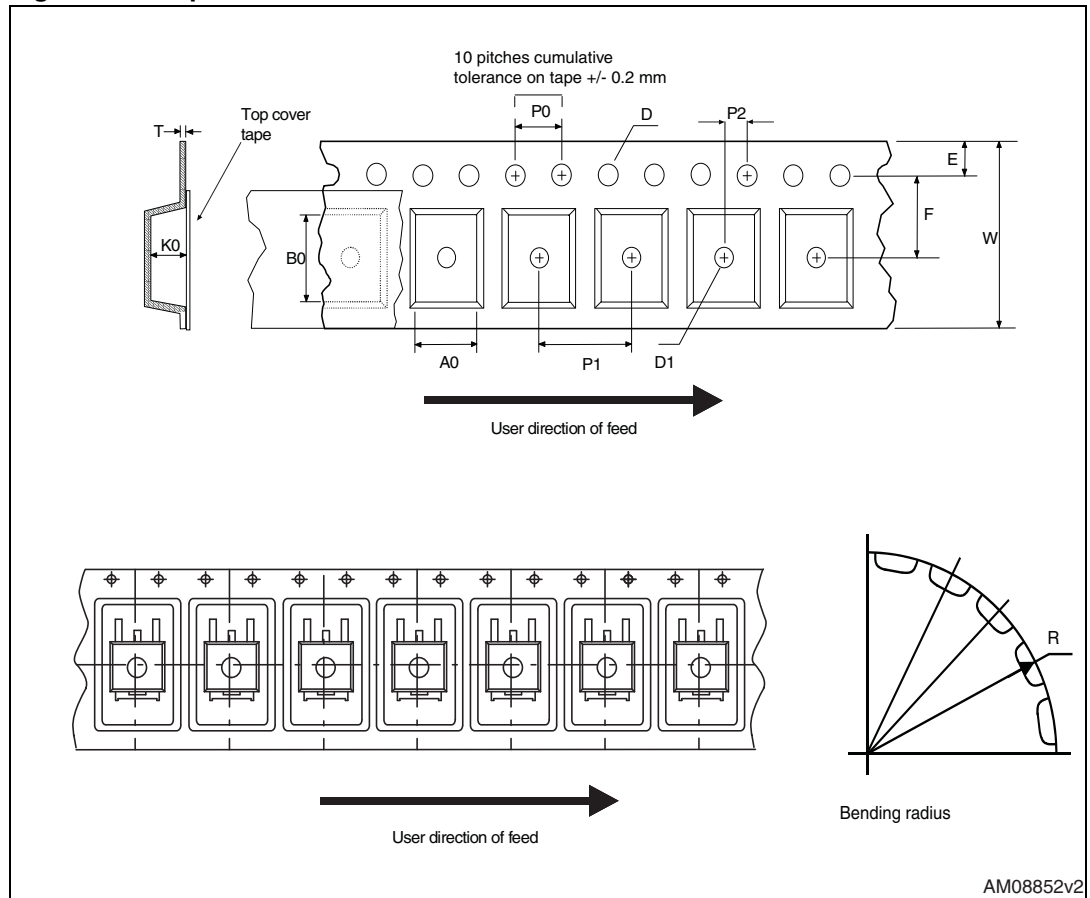
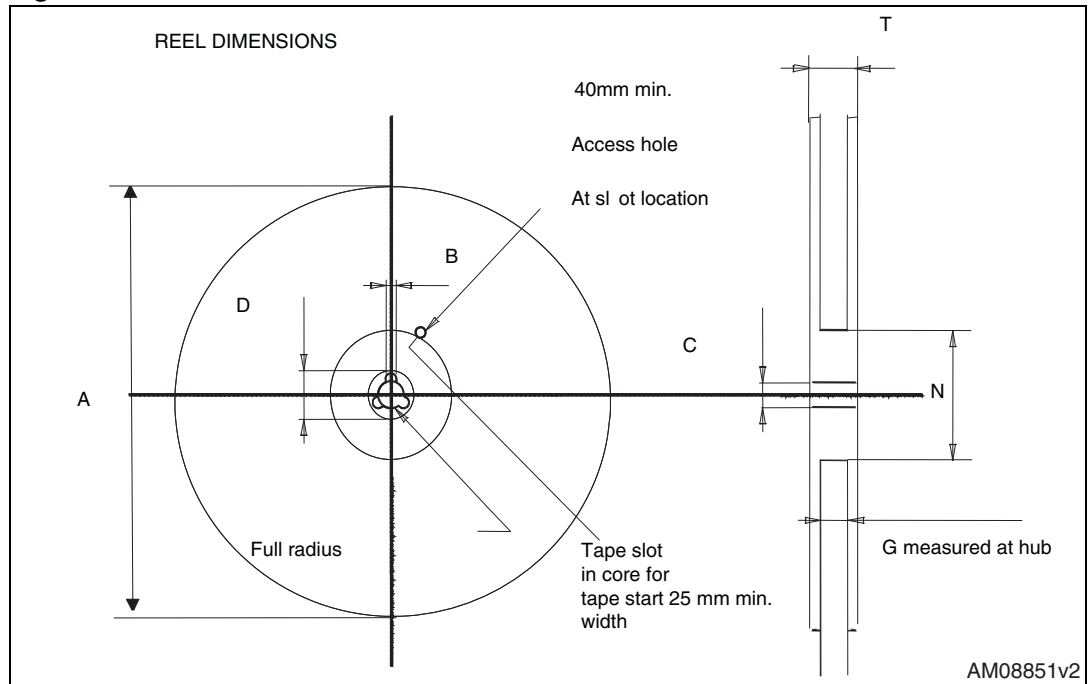


Figure 27. Reel



## 6 Revision history

**Table 13. Document revision history**

Date	Revision	Changes
13-Oct-2006	1	First release.
17-Nov-2006	2	Part number has been modified.
02-Feb-2007	3	Preliminary version.
16-Feb-2007	4	TO-220FP package has been added.
15-Oct-2012	5	Updated <a href="#">Section 4: Package mechanical data</a> and <a href="#">Section 5: Packaging mechanical data</a> . Minor text changes.

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