STB19NF20, STF19NF20, STP19NF20

N-channel 200 V, 0.15Ω typ., 15 A MESH OVERLAY™ Power MOSFET in D²PAK, TO-220FP and TO-220 packages

Datasheet — production data

Features

Type	V_{DSS}	$R_{DS(on)}$	I_D	p_w
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.

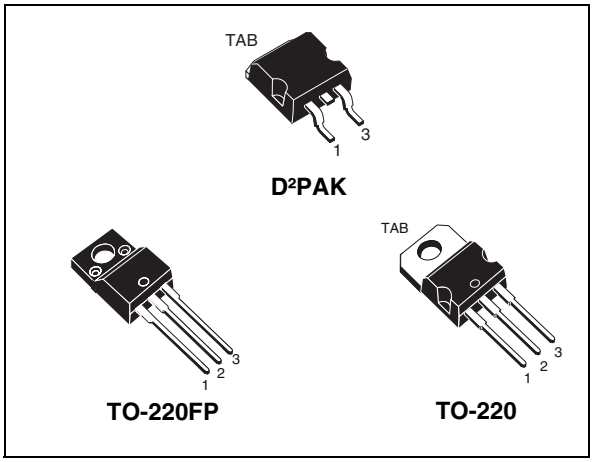


Figure 1. Internal schematic diagram

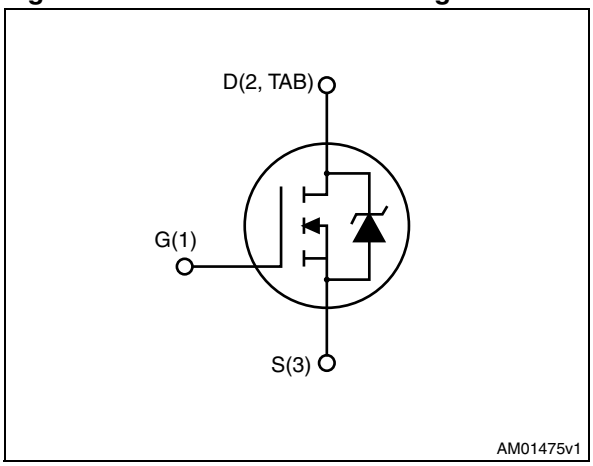


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB19NF20	19NF20	D²PAK	Tape and reel
STF19NF20	19NF20	TO-220FP	Tube
STP19NF20	19NF20	TO-220	

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220/D²PAK	TO-220FP	
V_{DS}	Drain-source voltage	200		V
V_{GS}	Gate-source voltage	± 20		V
I_D	Drain current (continuous) at T_C = 25°C	15	15(1)	A
I_D	Drain current (continuous) at T_C=100°C	9.45	9.45(1)	A
I_{DM}(2)	Drain current (pulsed)	60	60 (1)	A
P_{TOT}	Total dissipation at T_C = 25°C	90	25	W
	Derating factor	0.72	0.2	W/°C
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1s;T_C=25°C)	--	2500	V
dv/dt(3)	Peak diode recovery voltage slope	15		V/ns
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 150		°C

1. Limited by package
2. Pulse width limited by safe operating area
3. I_{SD} ≤15A, di/dt ≤300A/µs, V_{DD} = 80%$V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value			Unit
		TO-220	D²PAK	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1.39		5	°C/W
$R_{thj\text{-}pcb}$	Thermal resistance junction-pcb max	--	50	--	
$R_{thj\text{-}a}$	Thermal resistance junction-ambient max	62.5			°C/W
T_l	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°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} = 200 V V_{DS} = 200 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 = 250µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS}= 10V, I_D= 7.5A		0.15	0.16	Ω

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} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} =25V, f=1 MHz, V_{GS}=0		800 165 26		pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD}=160V, I_D = 15A V_{GS} =10V *(see Figure 17)*		24 4.4 11.6		nC nC nC

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

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD}=100 V, I_D= 7.5A, R_G=4.7Ω, V_{GS}=10V *(see Figure 16)*		11.5 22		ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time	V_{DD} = 100 V, I_D = 7.5A, R_G = 4.7Ω, V_{GS} = 10V *(see Figure 16)*		19 11		ns 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} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD}=15A, V_{DD}=50V di/dt = 100A/µs, *(see Figure 21)*		125 0.55 8.8		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD}=15A, V_{DD}=50V di/dt = 100A/µs, Tj=150°C *(see Figure 21)*		148 0.73 9.9		ns µC A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220 / D²PAK

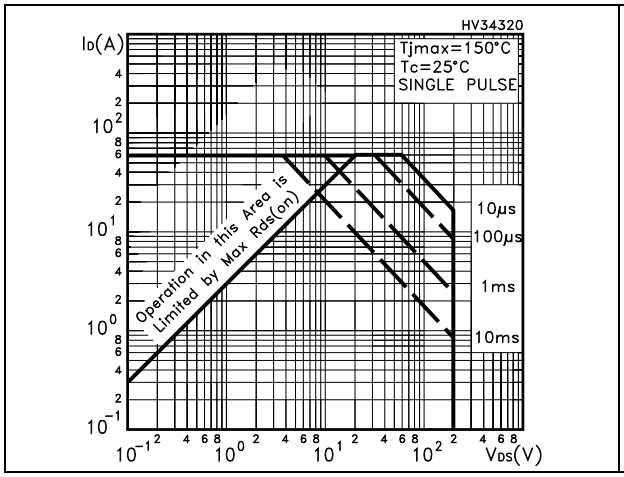


Figure 3. Thermal impedance for TO-220 / D²PAK

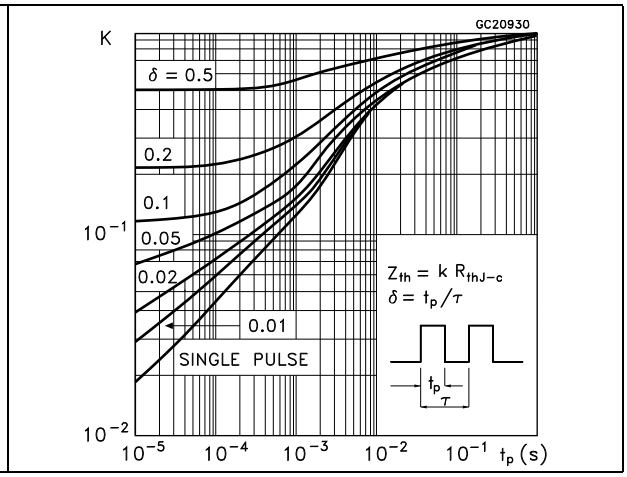


Figure 4. Safe operating area for TO-220FP

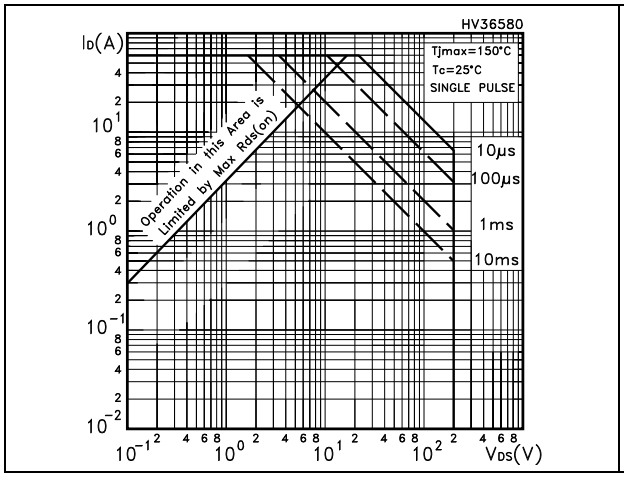


Figure 5. Thermal impedance for TO-220FP

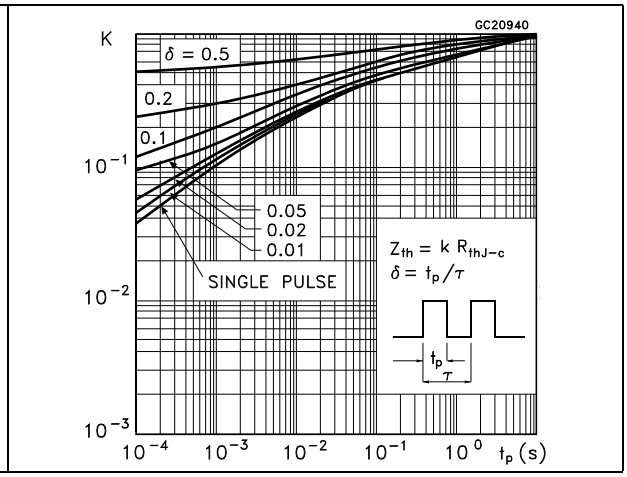


Figure 6. Output characteristics

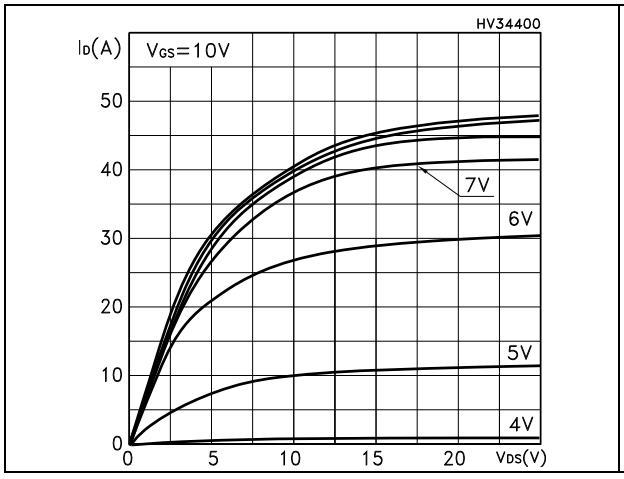


Figure 7. Transfer characteristics

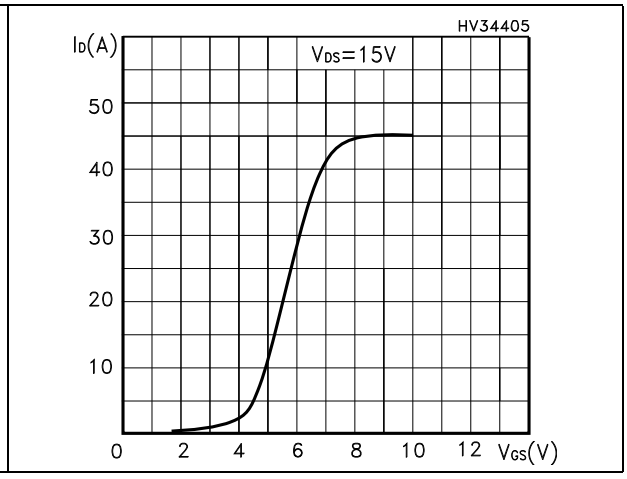


Figure 8. Static drain-source on-resistance

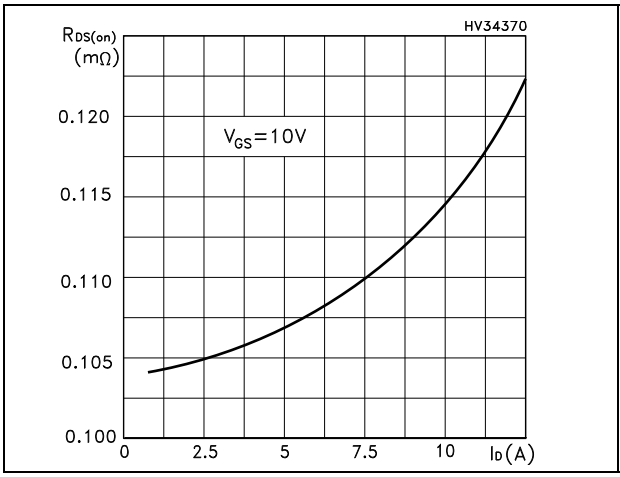


Figure 9. Normalized BV_{DSS} vs temperature

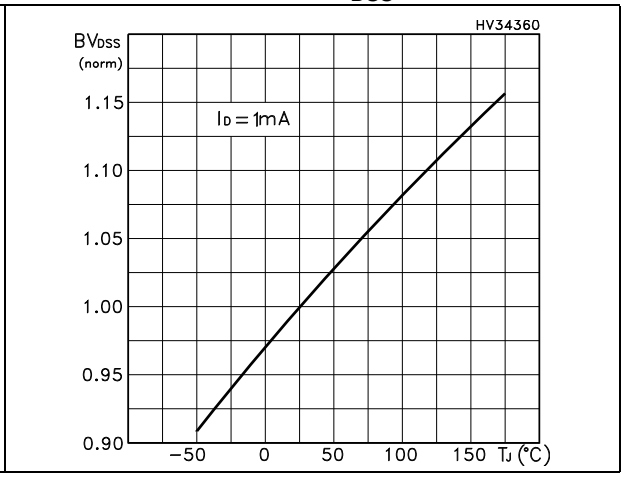


Figure 10. Gate charge vs gate-source voltage

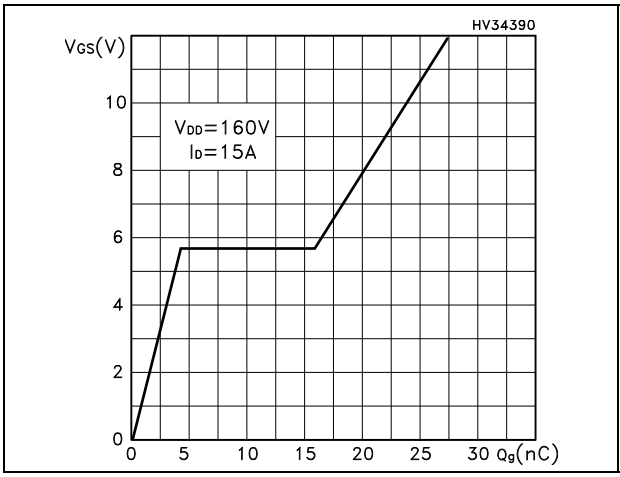


Figure 11. Capacitance variations

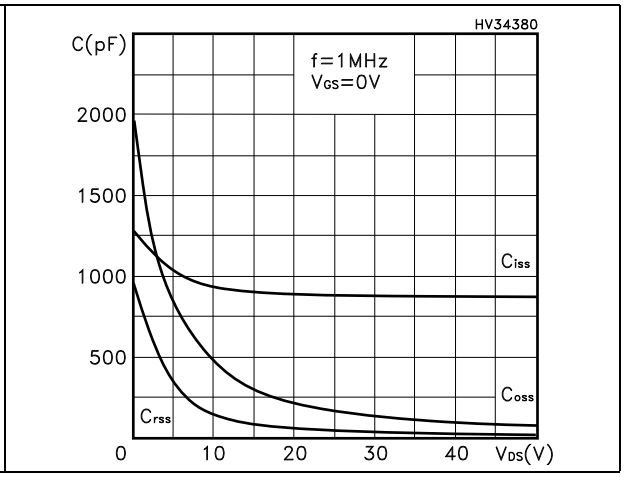


Figure 12. Normalized gate threshold voltage vs temperature

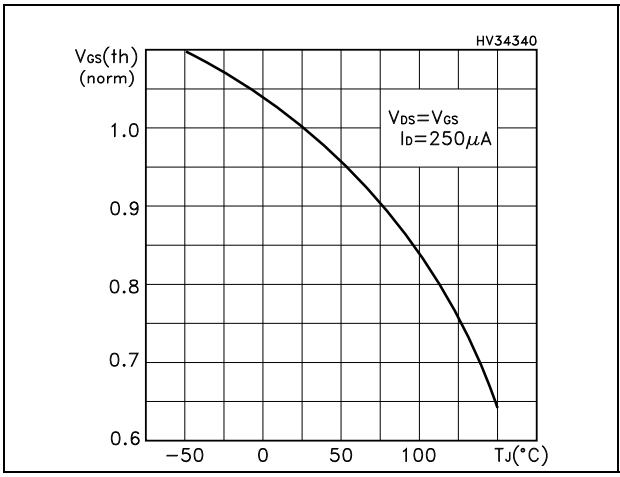


Figure 13. Normalized on resistance vs temperature

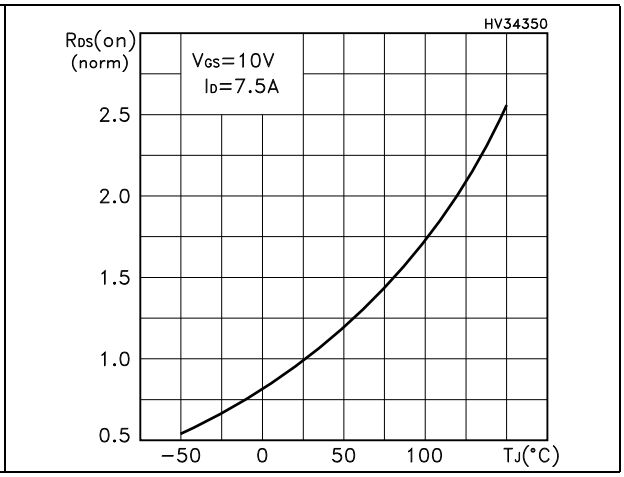


Figure 14. Source-drain forward characteristics

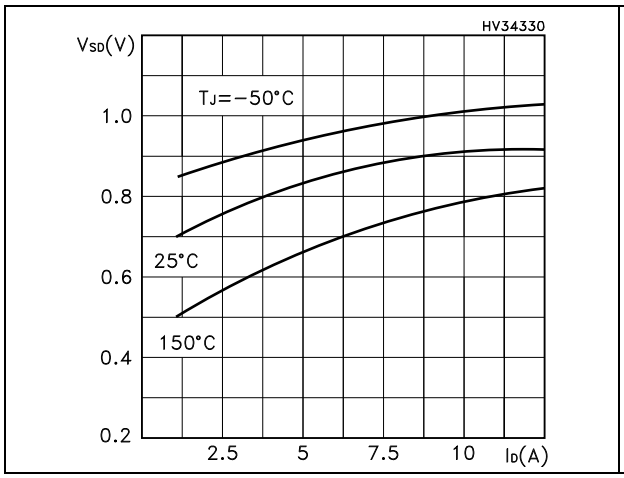
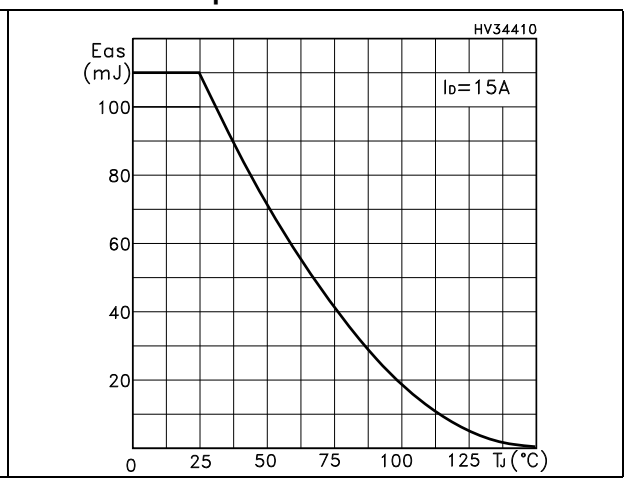


Figure 15. Maximum avalanche energy vs temperature



3 Test circuit

Figure 16. Switching times test circuit for resistive load

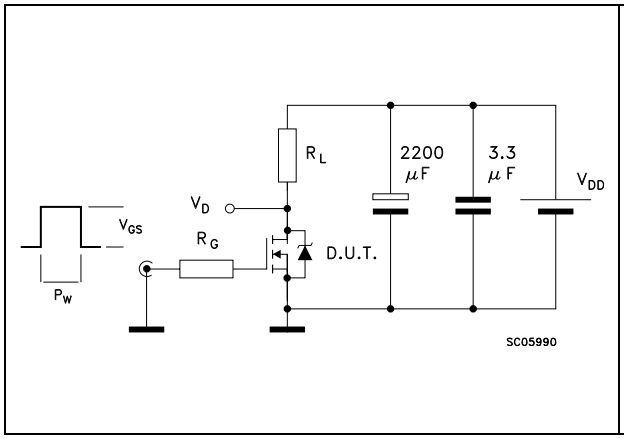


Figure 17. Gate charge test circuit

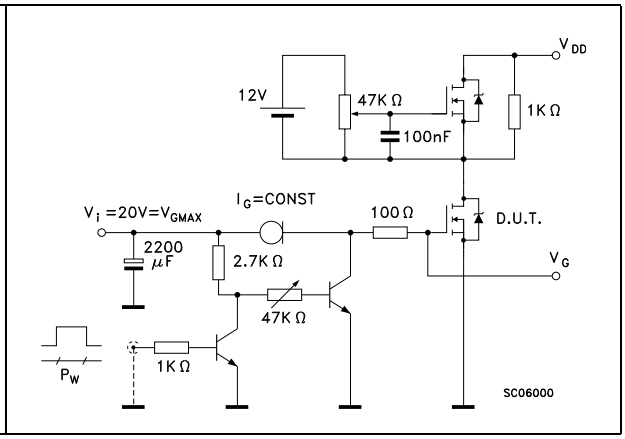


Figure 18. Test circuit for inductive load switching and diode recovery times

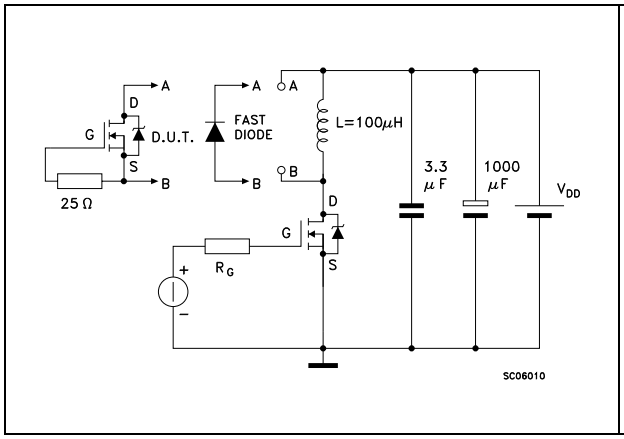


Figure 19. Unclamped Inductive load test circuit

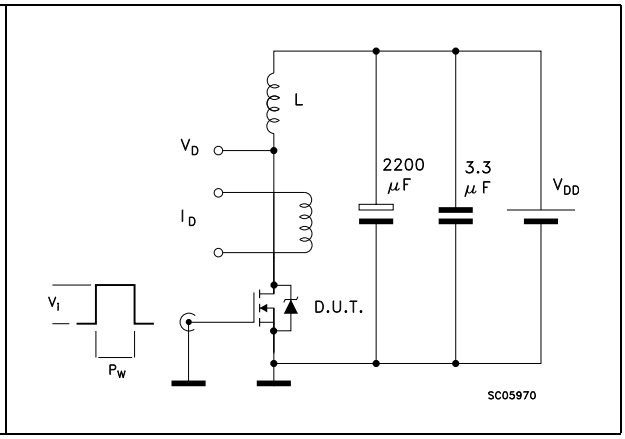


Figure 20. Unclamped inductive waveform

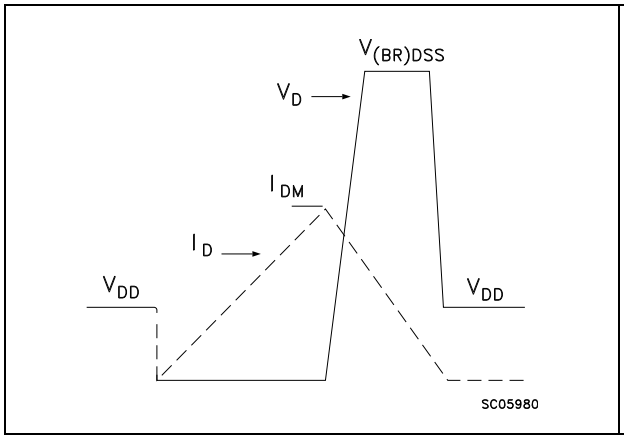
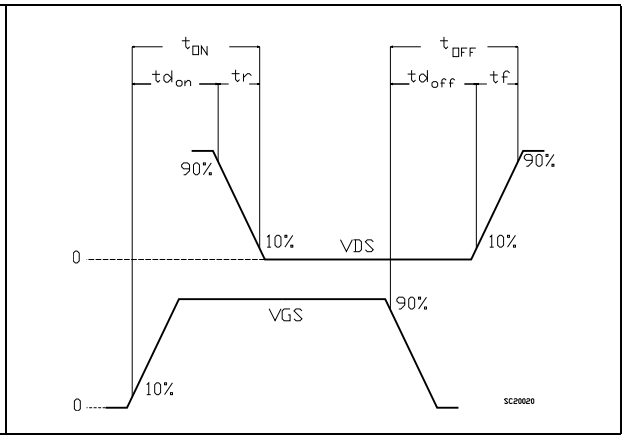


Figure 21. Switching time waveform



4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® 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. D²PAK (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. D²PAK (TO-263) drawing

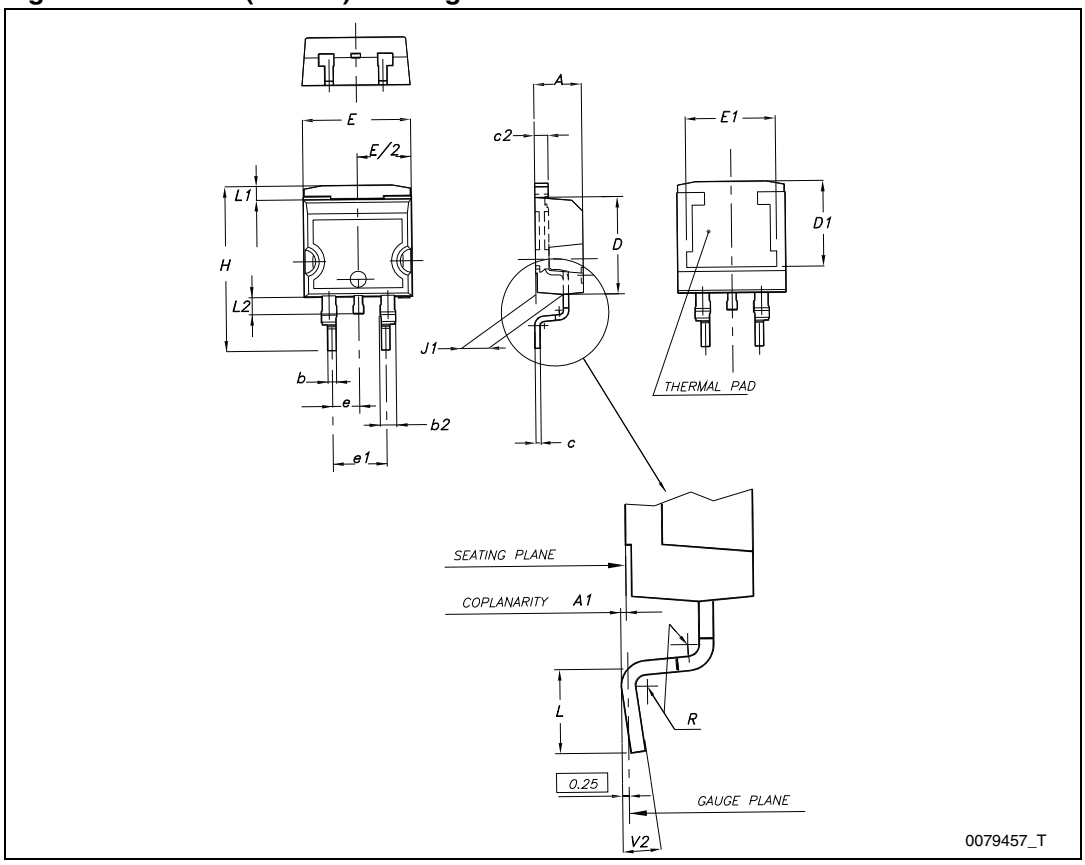
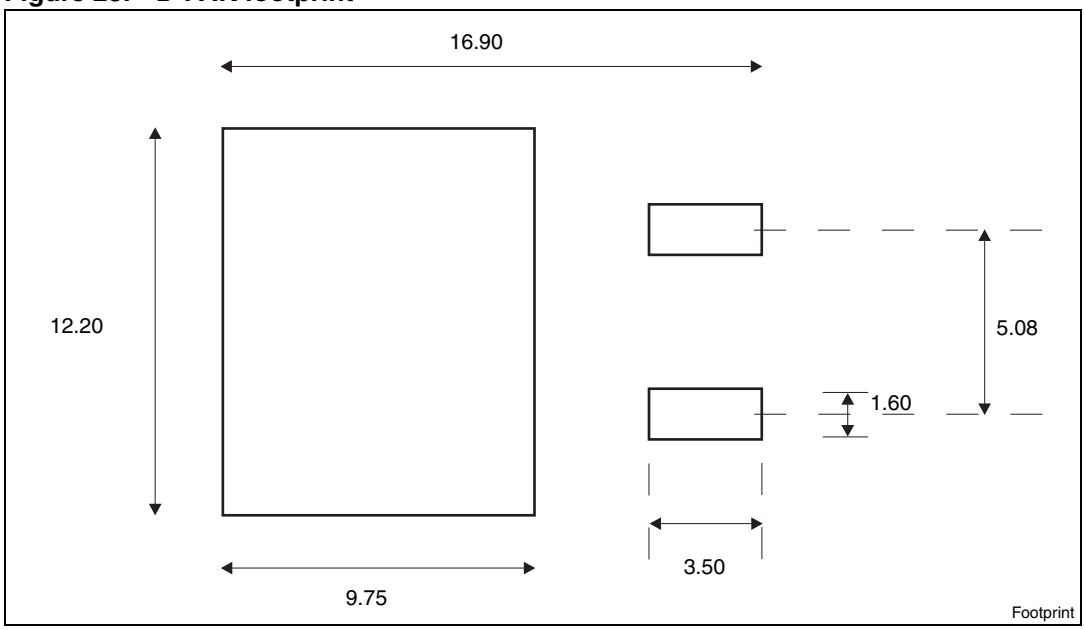


Figure 23. D²PAK footprint[a]



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

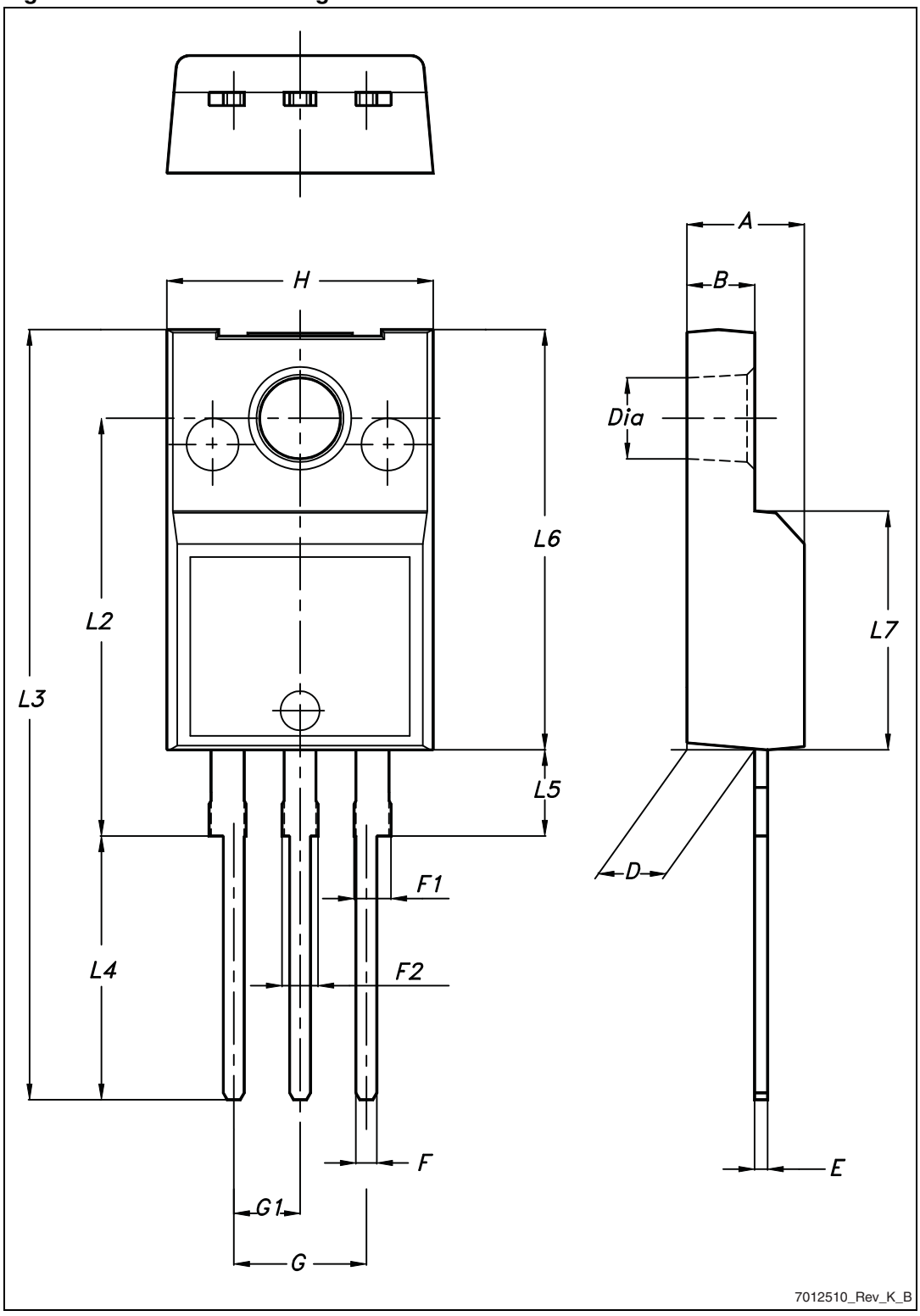
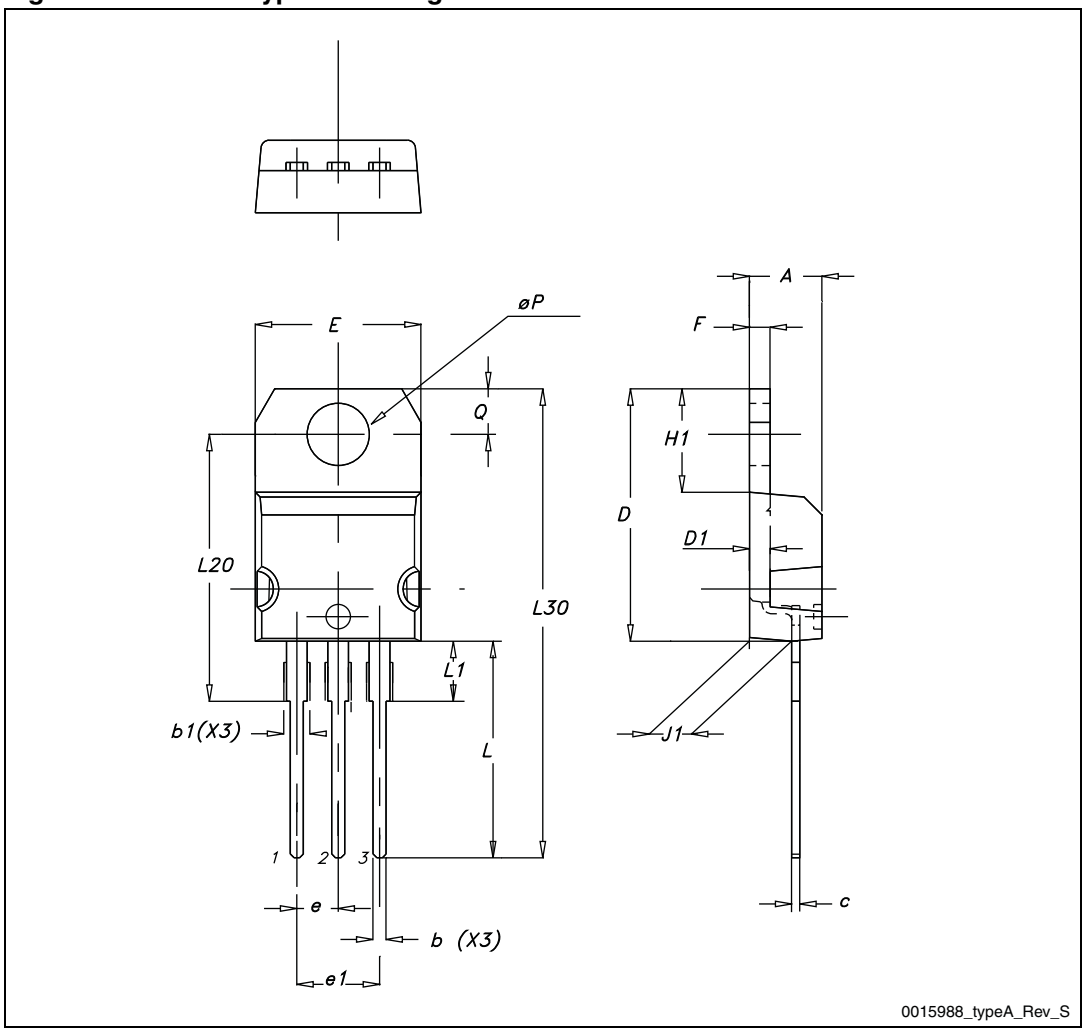


Table 11. TO-220 type A mechanical data

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	
∅P	3.75		3.85
Q	2.65		2.95

Figure 25. TO-220 type A drawing



5 Packaging mechanical data

Table 12. D²PAK (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

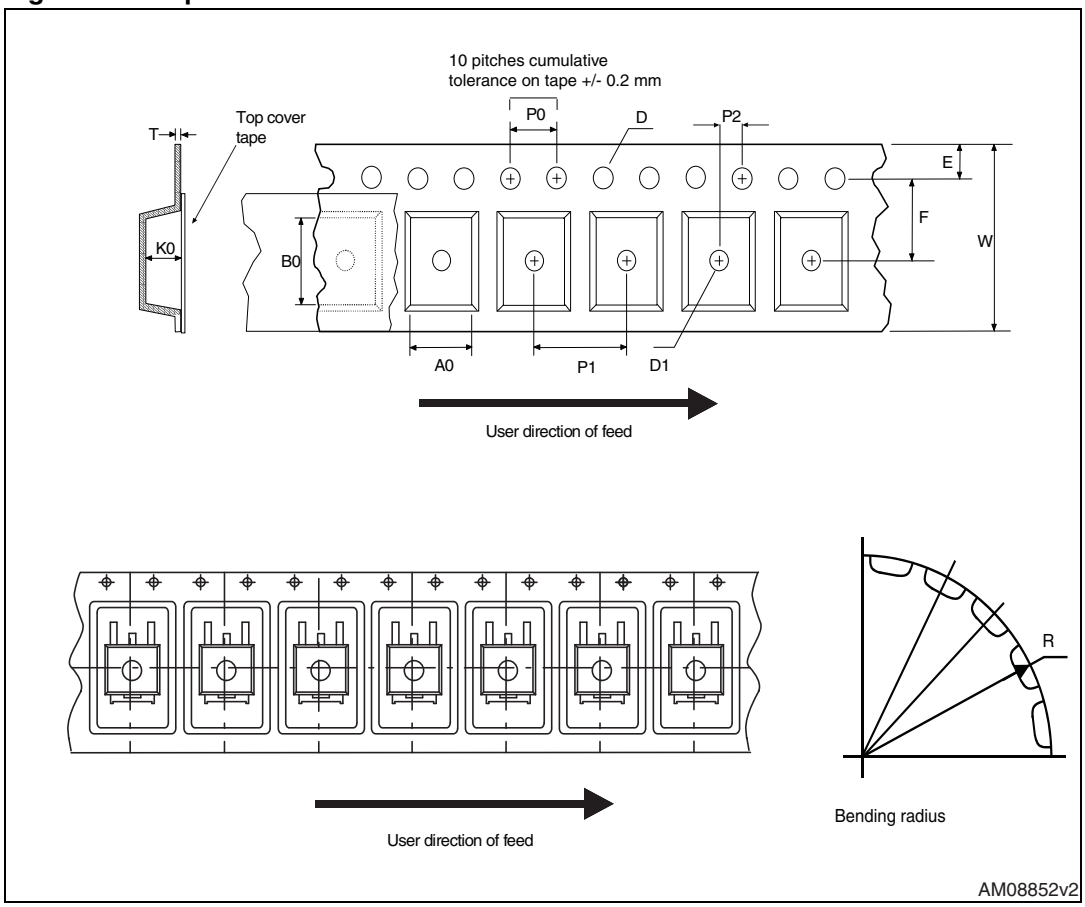
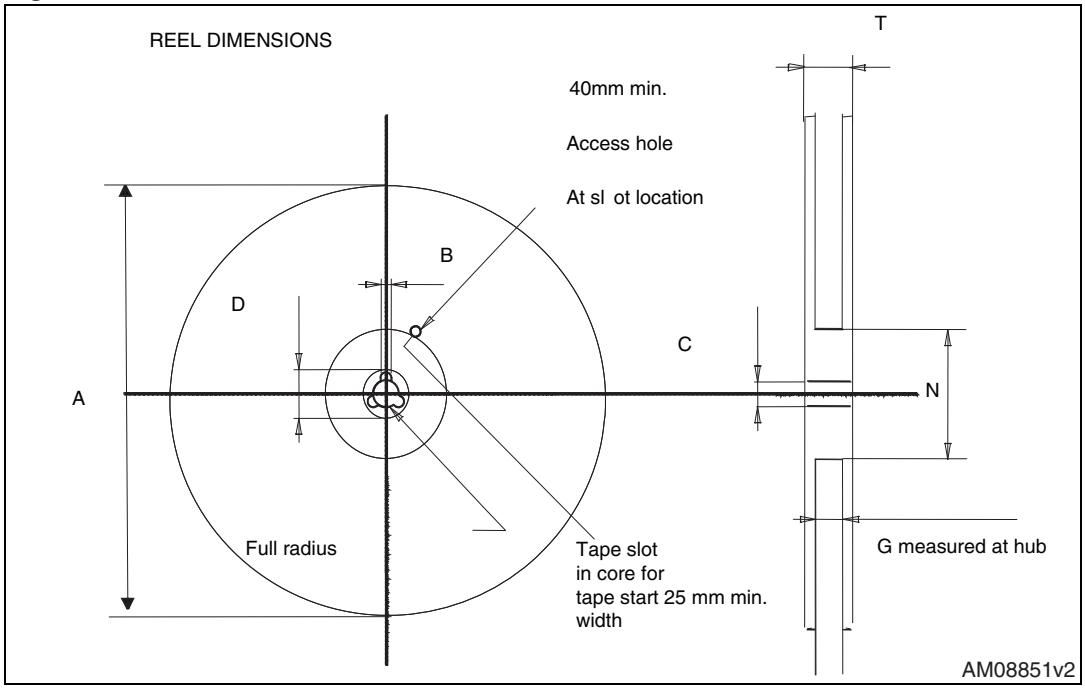


Figure 27. Reel



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 *Section 4: Package mechanical data* and *Section 5: Packaging mechanical data*. Minor text changes.