

N-channel 200 V, 0.11 Ω typ., 15 A MESH OVERLAY™
Power MOSFET in D²PAK, DPAK, TO-220FP and TO-220 packages

Datasheet — production data

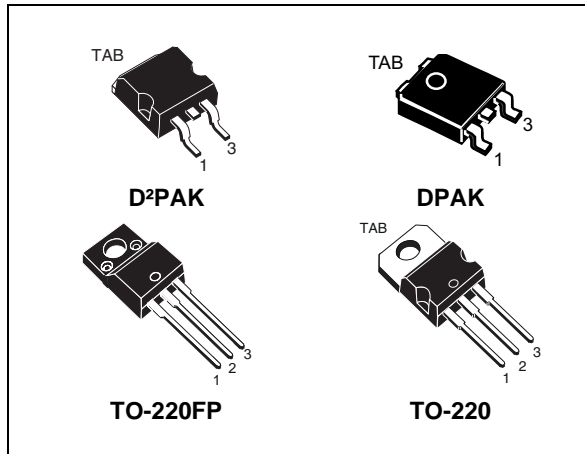
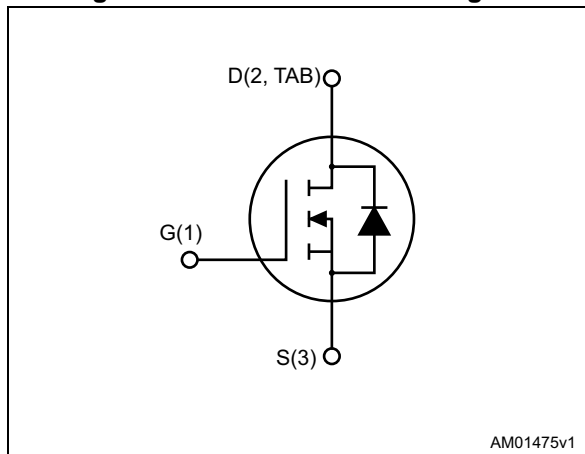


Figure 1. Internal schematic diagram



Features

Type	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STB19NF20	200 V	0.16 Ω	15 A	90 W
STD19NF20	200 V	0.16 Ω	15 A	90 W
STF19NF20	200 V	0.16 Ω	15 A	25 W
STP19NF20	200 V	0.16 Ω	15 A	90 W

- 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.

Table 1. Device summary

Order code	Marking	Package	Packing
STB19NF20	19NF20	D ² PAK	Tape and reel
STD19NF20	19NF20	DPAK	
STF19NF20	19NF20	TO-220FP	Tube
STP19NF20	19NF20	TO-220	

Contents

- 1 Electrical ratings 3**
- 2 Electrical characteristics 4**
 - 2.1 Electrical characteristics (curves) 6
- 3 Test circuits 9**
- 4 Package information 10**
 - 4.1 D²PAK (TO-263) type A and type B package information 10
 - 4.2 D²PAK (TO-263) type A and type B packing information 15
 - 4.3 DPAK (TO-252) package information 17
 - 4.4 DPAK (TO-252) packing information 20
 - 4.5 TO-220FP package information 22
 - 4.6 TO-220 type A package information 24
- 5 Revision history 26**



1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D ² PAK, DPAK, TO-220	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
V _{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T _C = 25 °C)		2500	V
dv/dt ⁽³⁾	Peak diode recovery voltage slope	15		V/ns
T _j	Operating junction temperature	-55 to 150		°C
T _{stg}	Storage temperature			

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

Table 3. Thermal data

Symbol	Parameter	Value				Unit
		D ² PAK	DPAK	TO-220	TO-220FP	
R _{thj-case}	Thermal resistance junction-case	1.39			5	°C/W
R _{thj-pcb}	Thermal resistance junction-pcb	35	50			
R _{thj-a}	Thermal resistance junction-ambient			62.5		

Table 4. Avalanche data

Symbol	Parameter	Value	Unit
I _{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T _j max.)	15	A
E _{AS}	Single pulse avalanche energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	110	mJ

2 Electrical characteristics

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

Table 5. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0\text{ V}$	200			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 200\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 200\text{ V}$, $T_C = 125\text{ °C}$			10	
I_{GSS}	Gate body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 7.5\text{ A}$		0.11	0.16	Ω

Table 6. Dynamic

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

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

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 100\text{ V}$, $I_D = 7.5\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 17)		11.5		ns
t_r	Rise time			22		
$t_{d(off)}$	Turn-off delay time			19		
t_f	Fall time			11		

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	$I_{SD} = 15 \text{ A}$, $V_{GS} = 0 \text{ V}$			1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 15 \text{ A}$, $V_{DD} = 50 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s}$, (see Figure 21)		125		ns
Q_{rr}	Reverse recovery charge			0.55		μC
I_{RRM}	Reverse recovery current			8.8		A
t_{rr}	Reverse recovery time	$I_{SD} = 15 \text{ A}$, $V_{DD} = 50 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s}$, $T_j = 150 \text{ }^\circ\text{C}$ (see Figure 21)		148		ns
Q_{rr}	Reverse recovery charge			0.73		μC
I_{RRM}	Reverse recovery current			9.9		A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for D²PAK, DPAK and TO-220

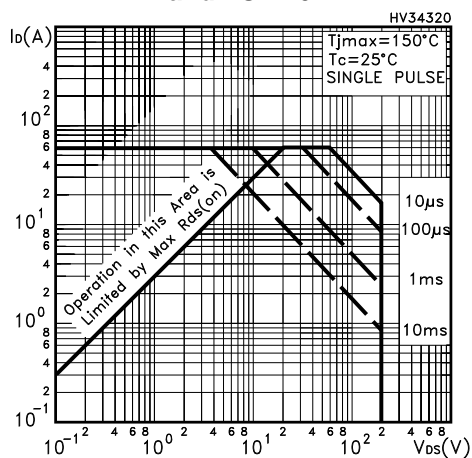


Figure 3. Thermal impedance for D²PAK, DPAK and TO-220

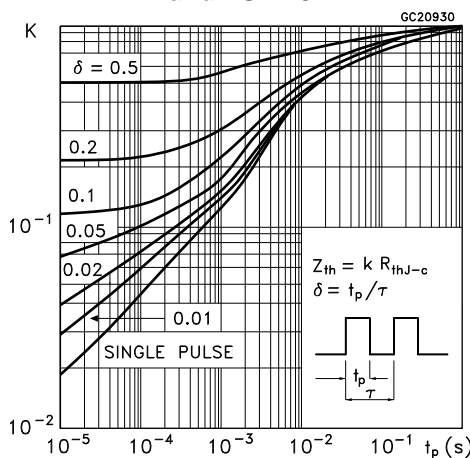


Figure 4. Safe operating area for TO-220FP

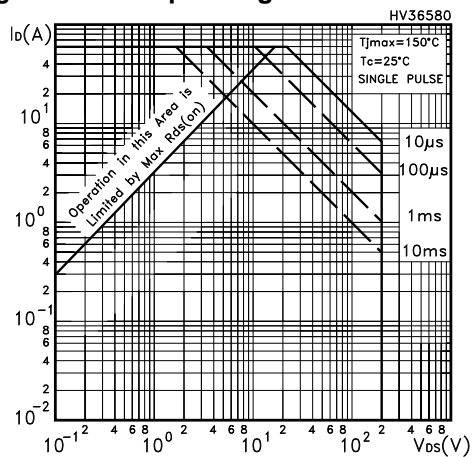


Figure 5. Thermal impedance for TO-220FP

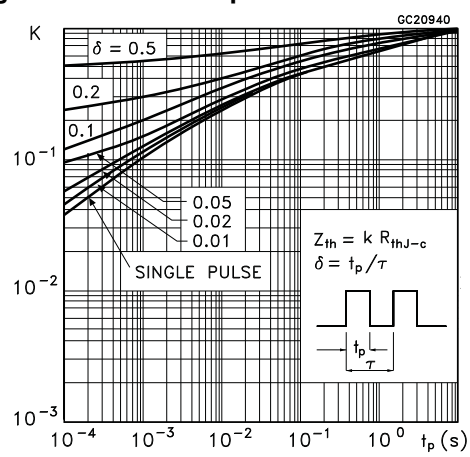


Figure 6. Output characteristics

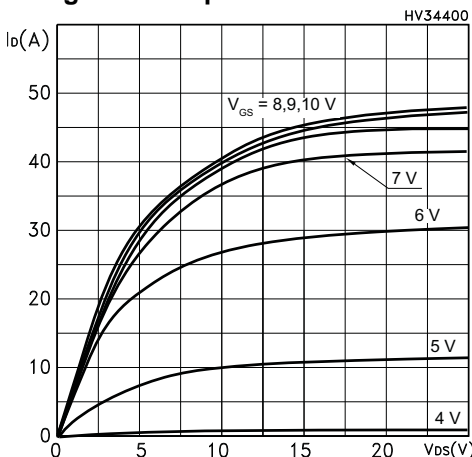


Figure 7. Transfer characteristics

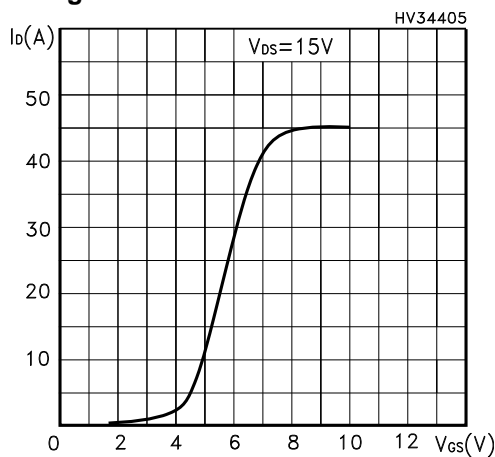


Figure 8. Static drain-source on-resistance

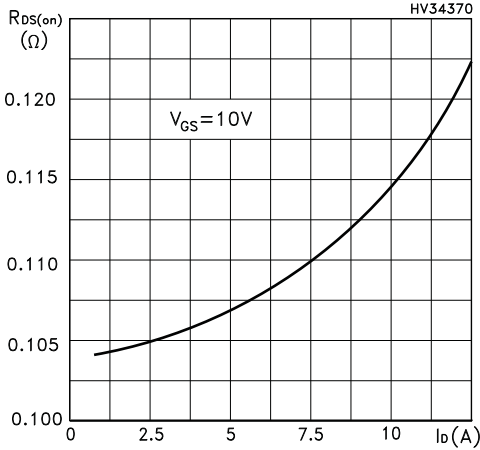


Figure 9. Normalized $V_{(BR)DSS}$ vs temperature

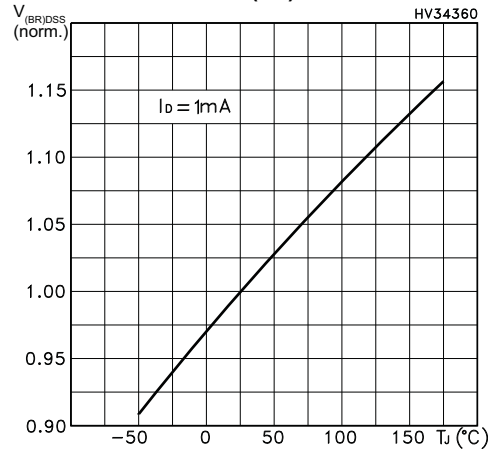


Figure 10. Gate charge vs gate-source voltage

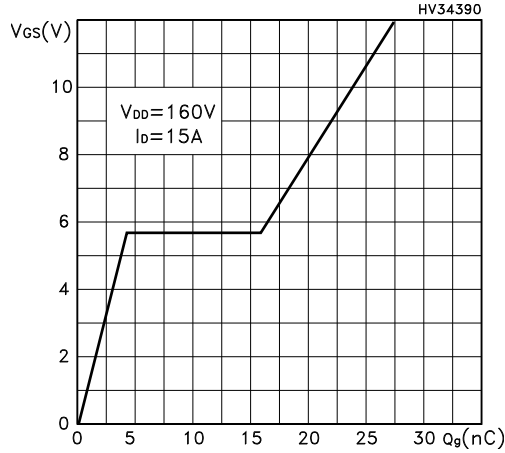


Figure 11. Capacitance variations

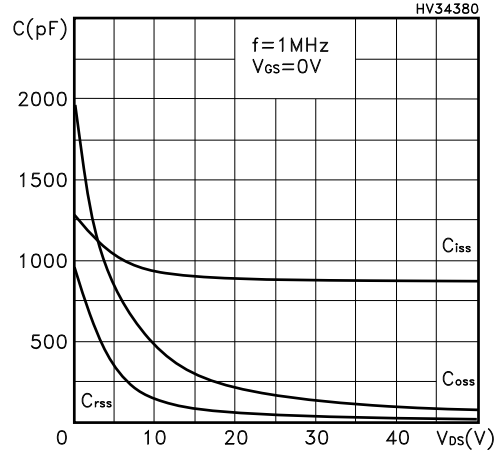


Figure 12. Normalized gate threshold voltage vs temperature

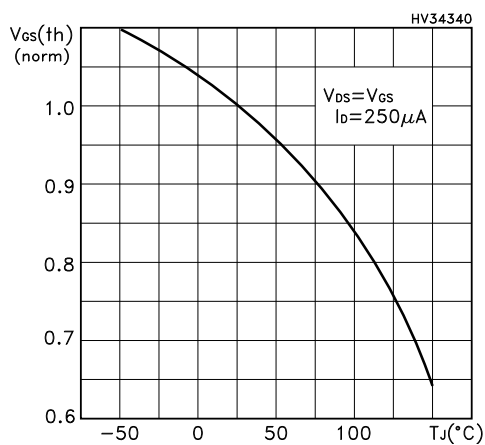


Figure 13. Normalized on-resistance vs temperature

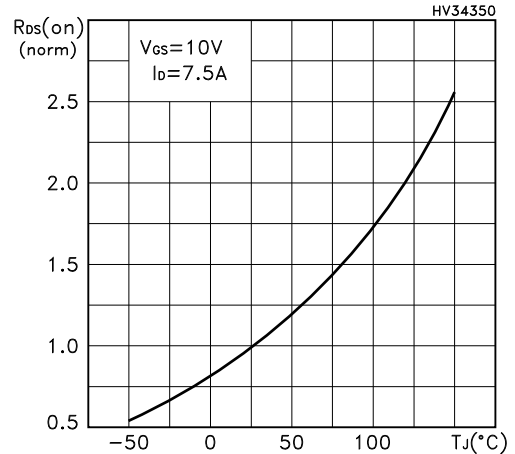


Figure 14. Source-drain forward characteristics

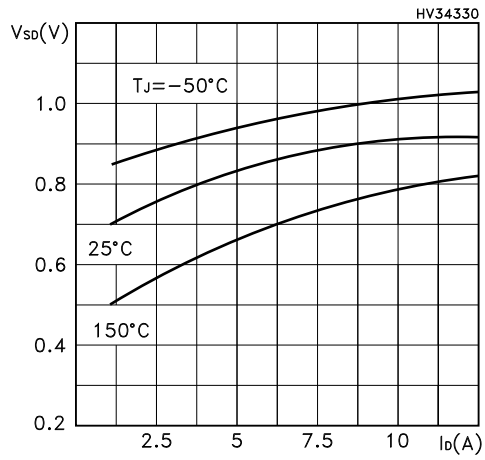
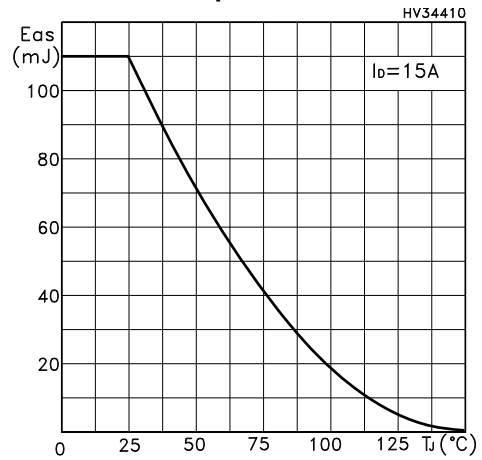
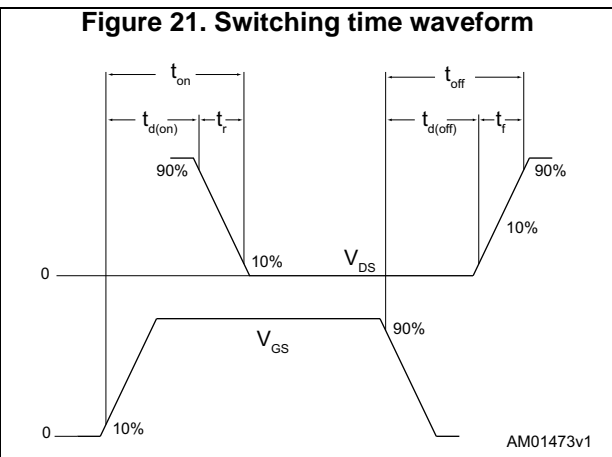
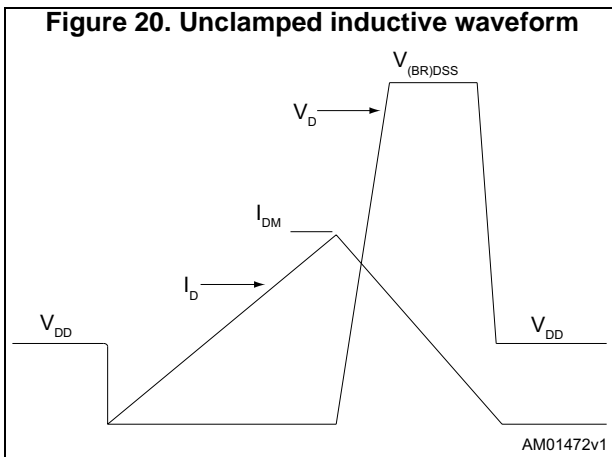
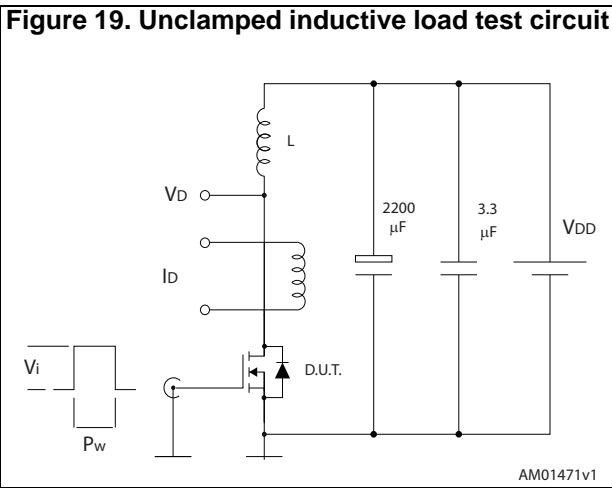
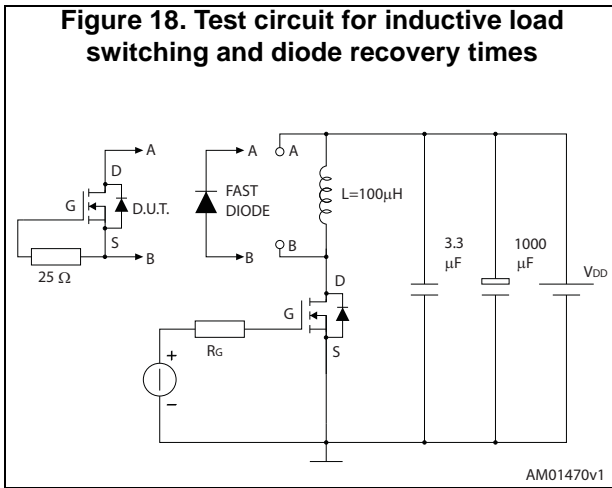
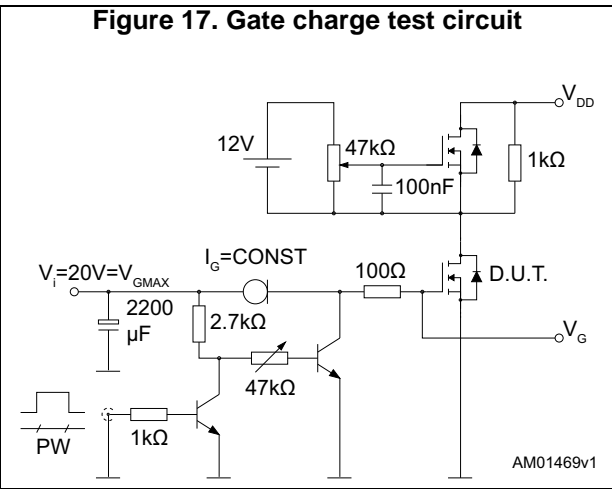
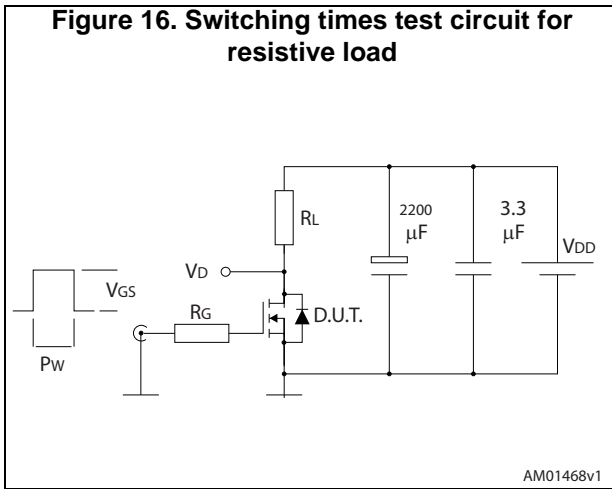


Figure 15. Maximum avalanche energy vs temperature



3 Test circuits



4 Package information

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.

4.1 D²PAK (TO-263) type A and type B package information

Figure 22. D²PAK (TO-263) type A package outline

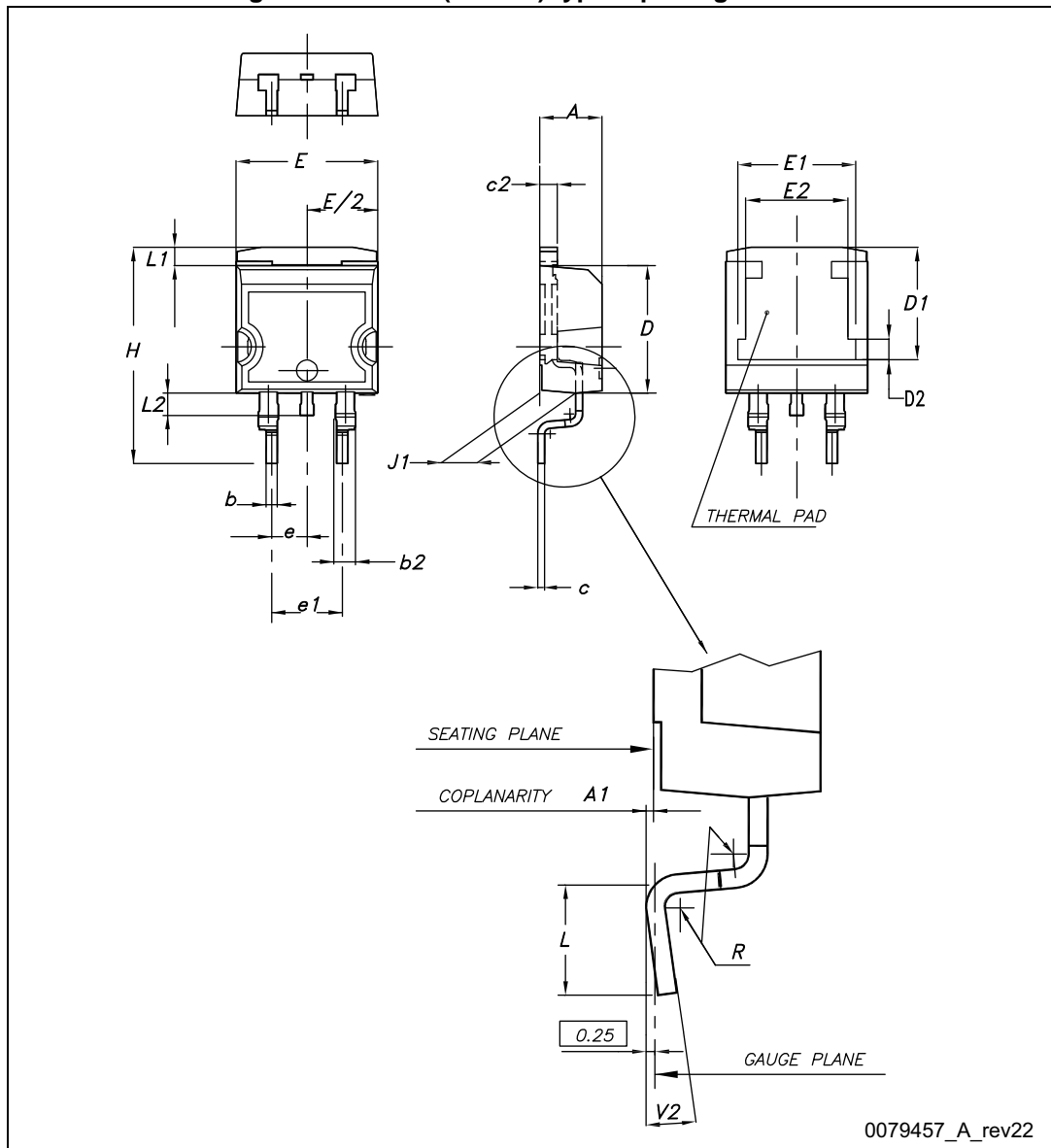


Table 9. D²PAK (TO-263) type A mechanical data

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	7.75	8.00
D2	1.10	1.30	1.50
E	10		10.40
E1	8.50	8.70	8.90
E2	6.85	7.05	7.25
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 23. D²PAK (TO-263) type B package outline

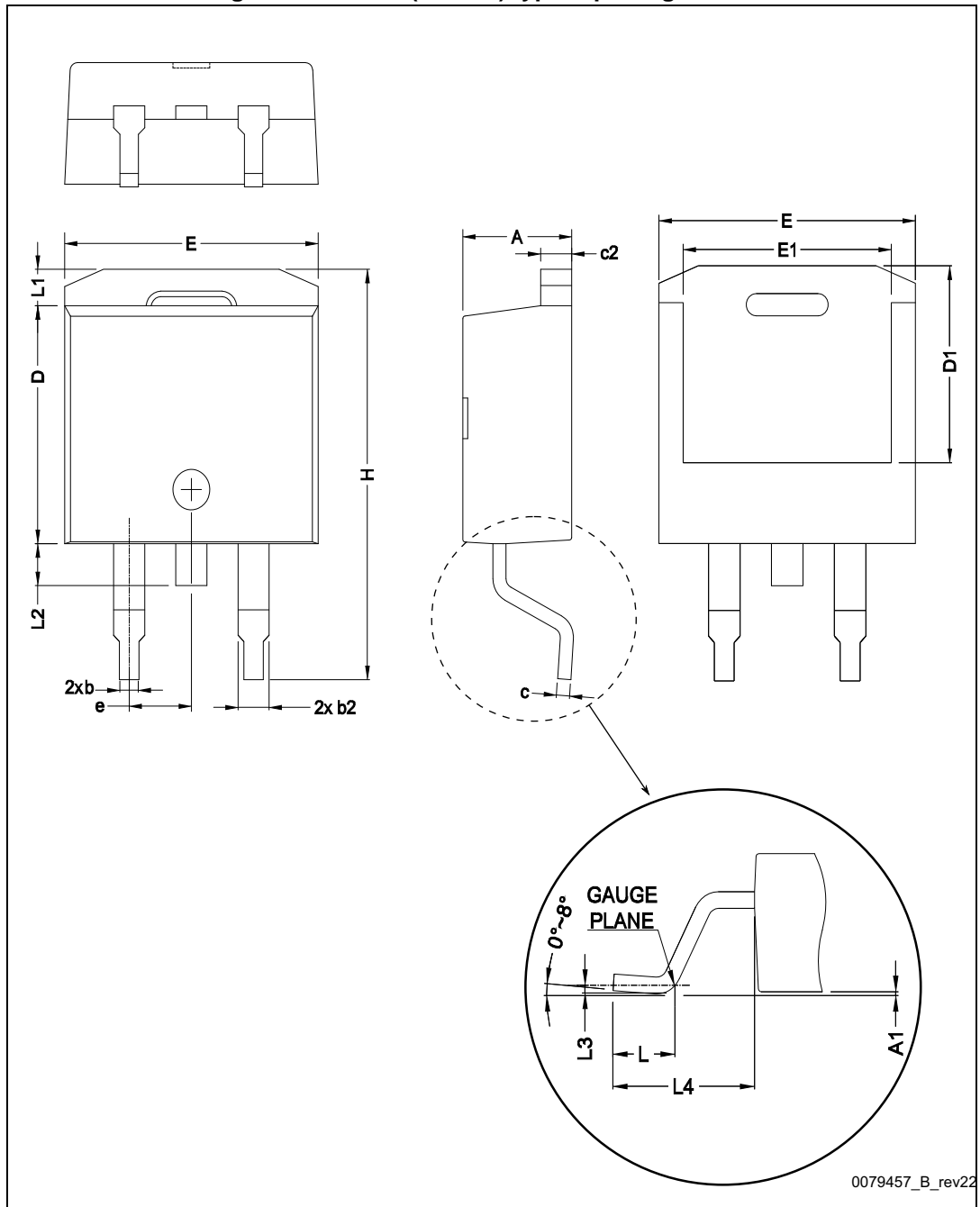
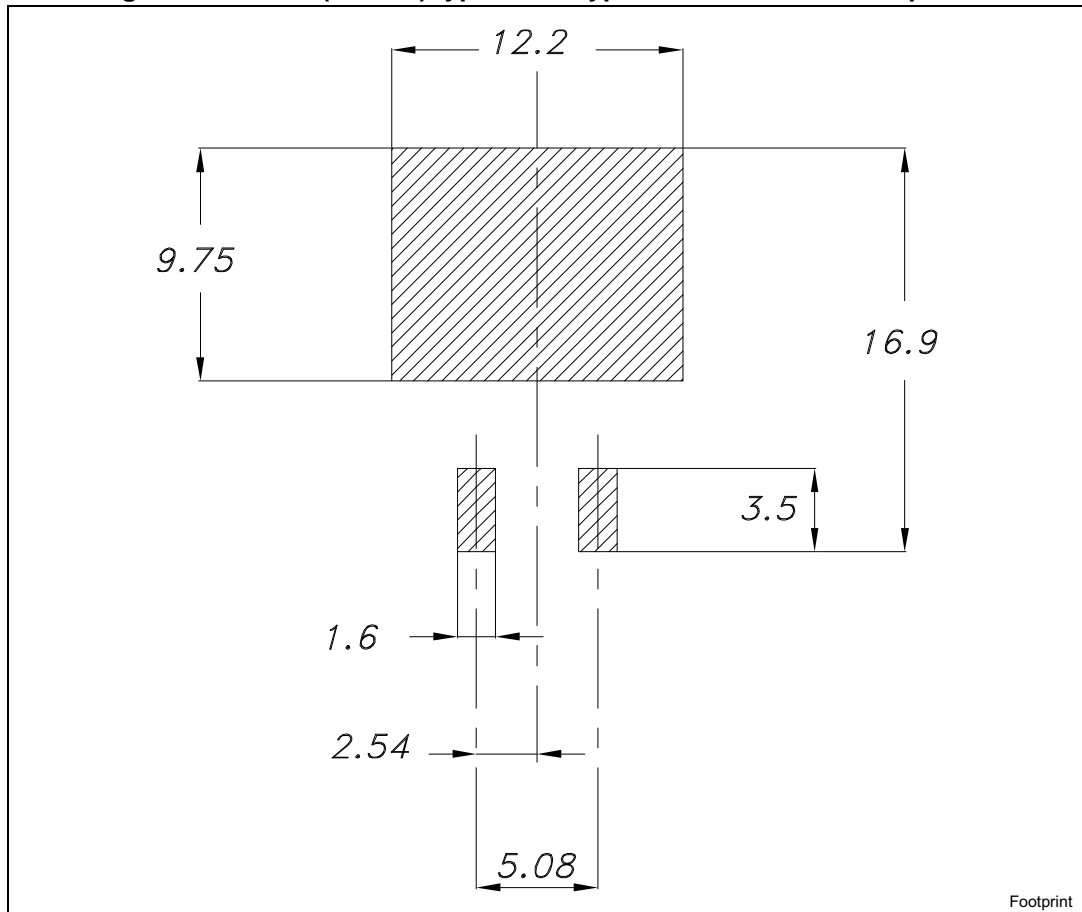


Table 10. D²PAK (TO-263) type B mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.36		4.60
A1	0		0.25
b	0.70		0.93
b2	1.14		1.70
c	0.38		0.694
c2	1.19		1.36
D	8.6		9.35
D1	6.9		
E	10		10.55
E1	8.1		
e		2.54	
H	15		15.85
L	1.9		2.79
L1			1.65
L2			1.78
L3		0.25	
L4	4.78		5.28

Figure 24. D²PAK (TO-263) type A and type B recommended footprint^(a)



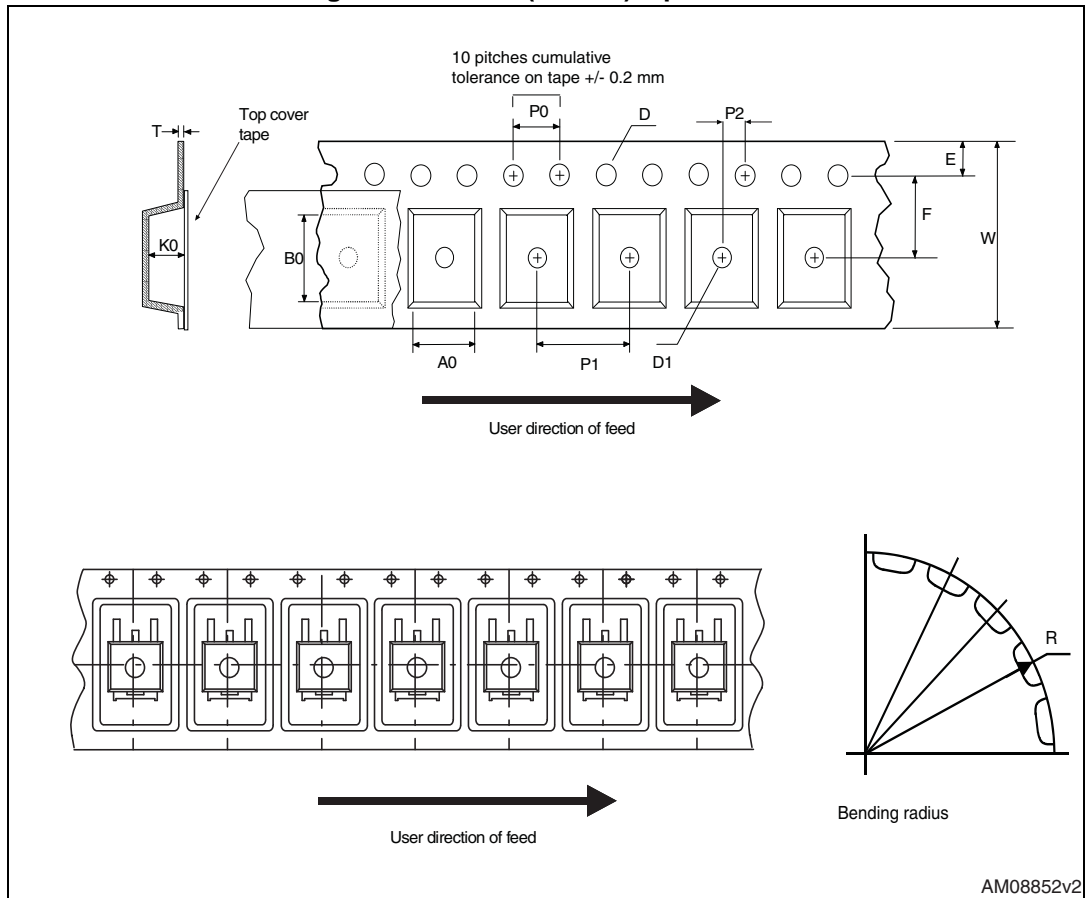
a. All dimension are in millimeters

4.2 D²PAK (TO-263) type A and type B packing information

Table 11. D²PAK (TO-263) tape and reel mechanical data

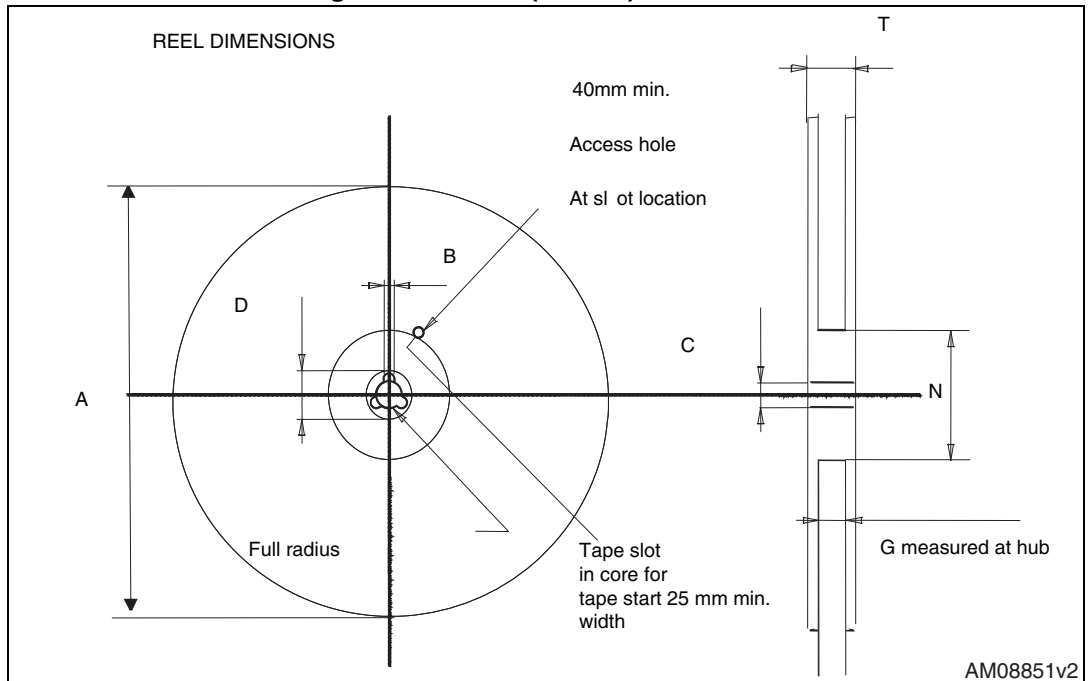
Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1		Base qty.	1000
P2	1.9	2.1		Bulk qty.	1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Figure 25. D²PAK (TO-263) tape outline



AM08852v2

Figure 26. D²PAK (TO-263) reel outline



AM08851v2

4.3 DPAK (TO-252) package information

Figure 27. DPAK (TO-252) type A package outline

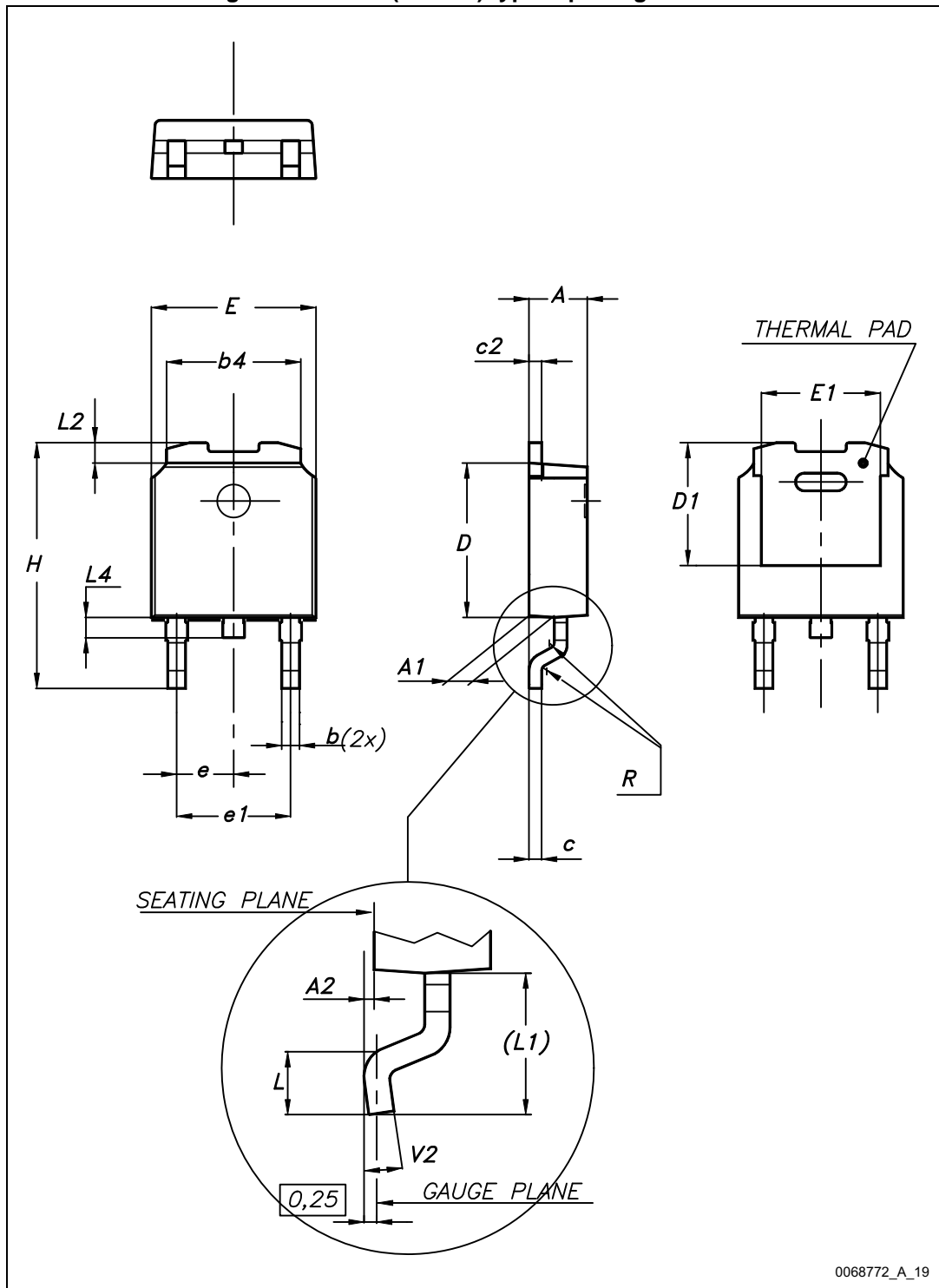
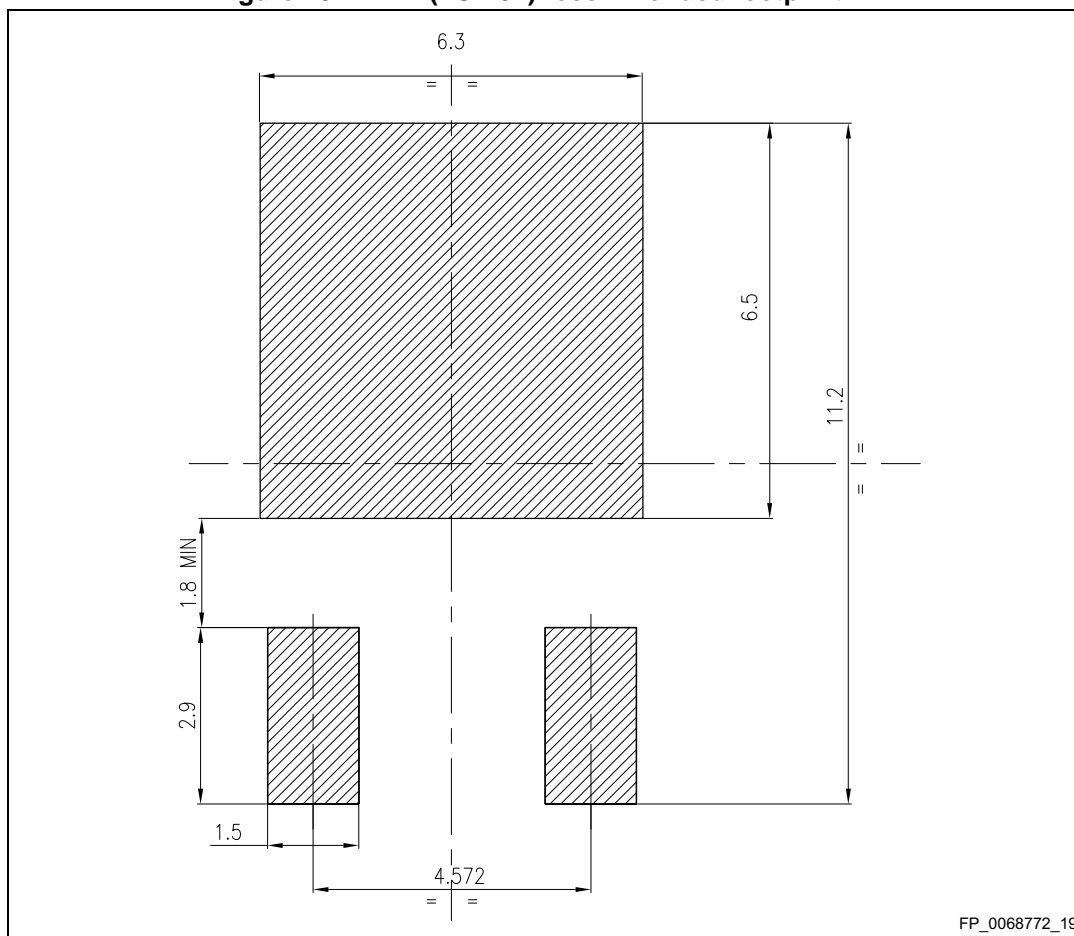


Table 12. DPAK (TO-252) type A mechanical data

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	4.95	5.10	5.25
E	6.40		6.60
E1	4.60	4.70	4.80
e	2.16	2.28	2.40
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
(L1)	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 28. DPAK (TO-252) recommended footprint (b)



b. All dimensions are in millimeters

4.4 DPAK (TO-252) packing information

Figure 29. DPAK (TO-252) tape outline

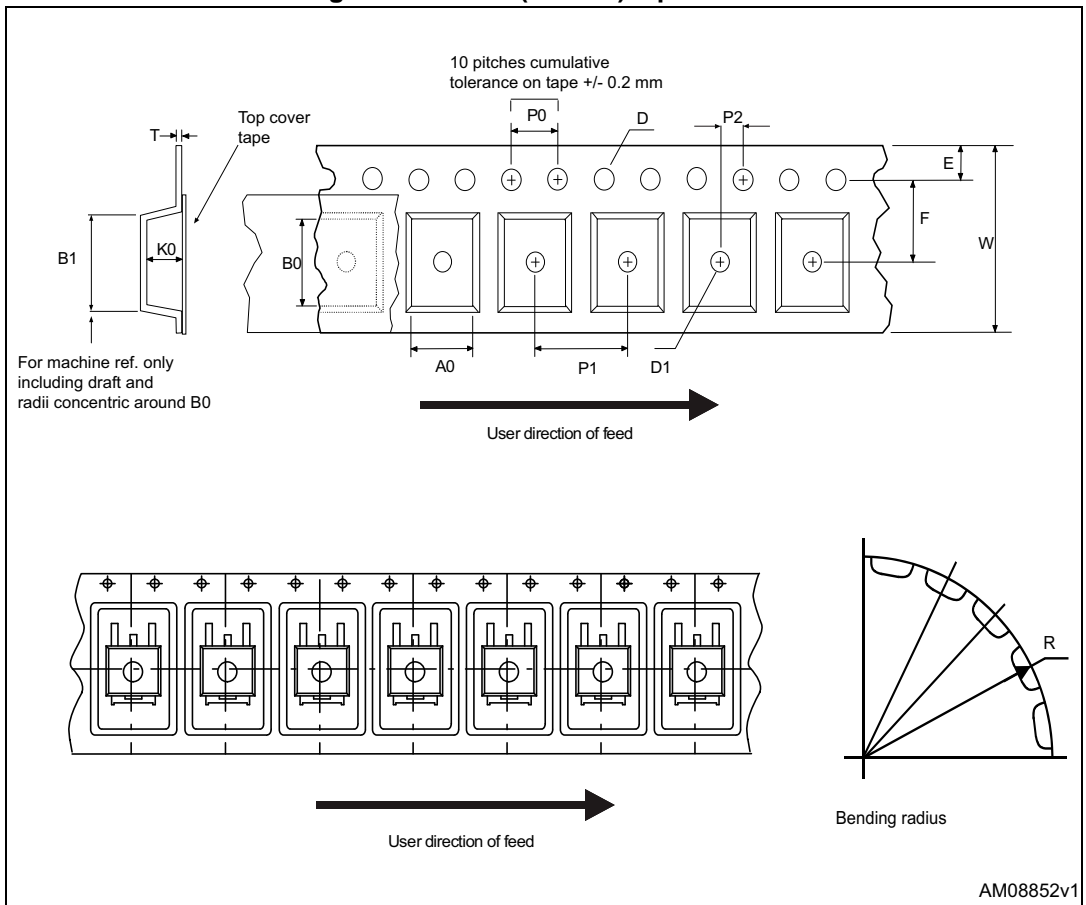


Figure 30. DPAK (TO-252) reel outline

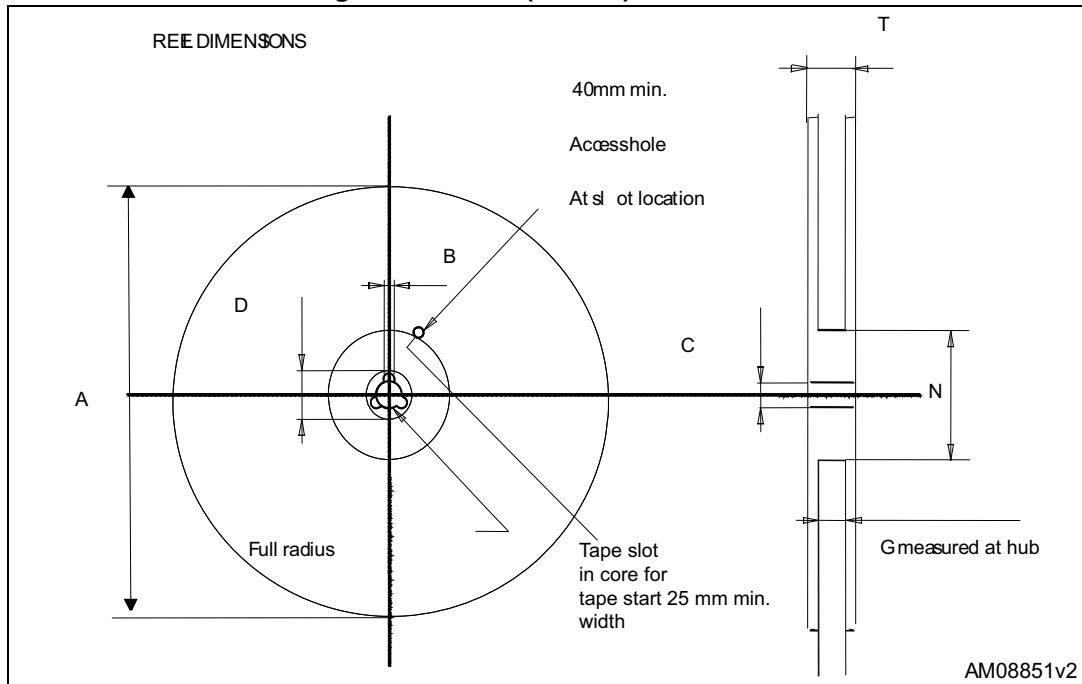
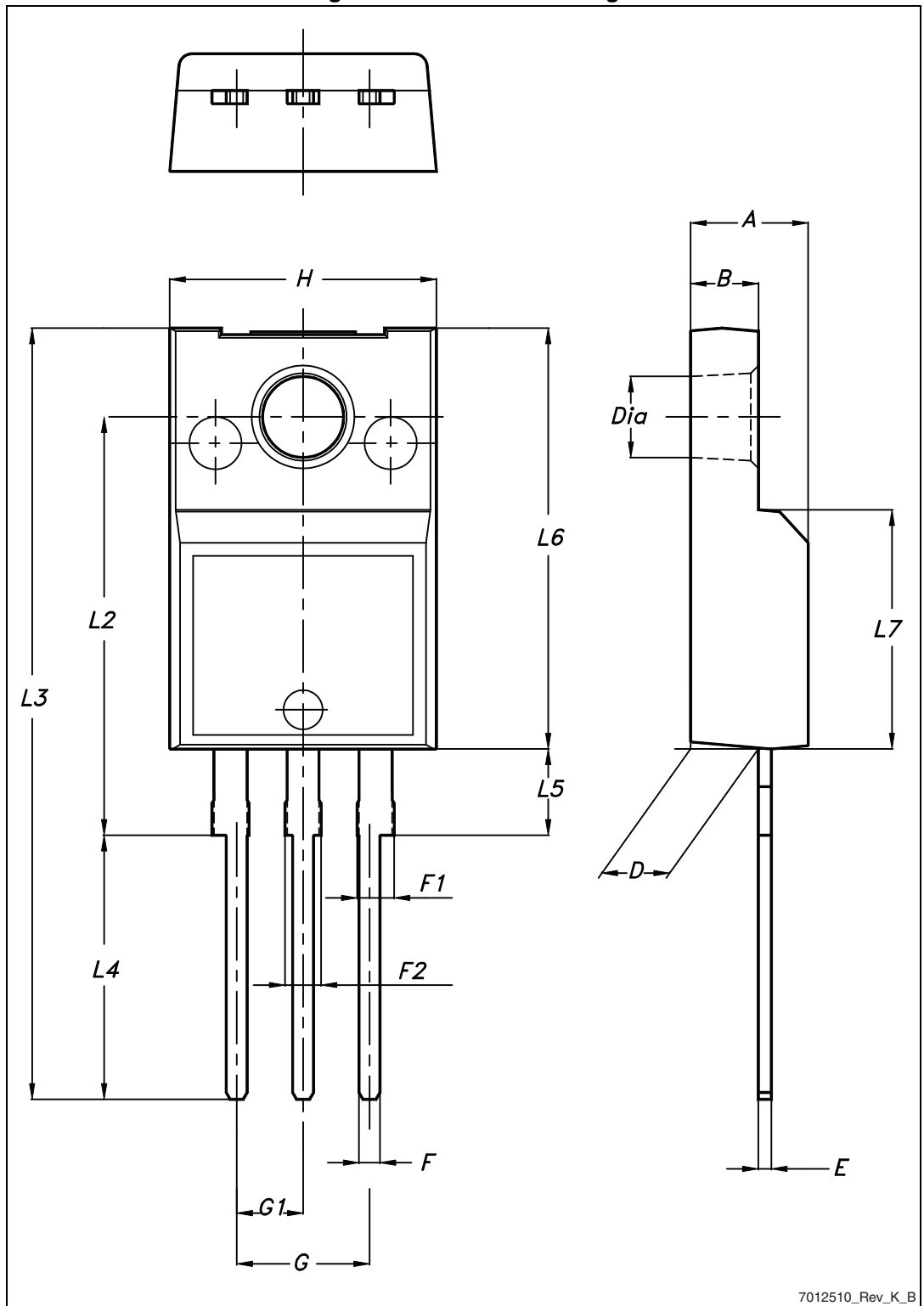


Table 13. DPAK (TO-252) tape and reel mechanical data

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			

4.5 TO-220FP package information

Figure 31. TO-220FP drawing



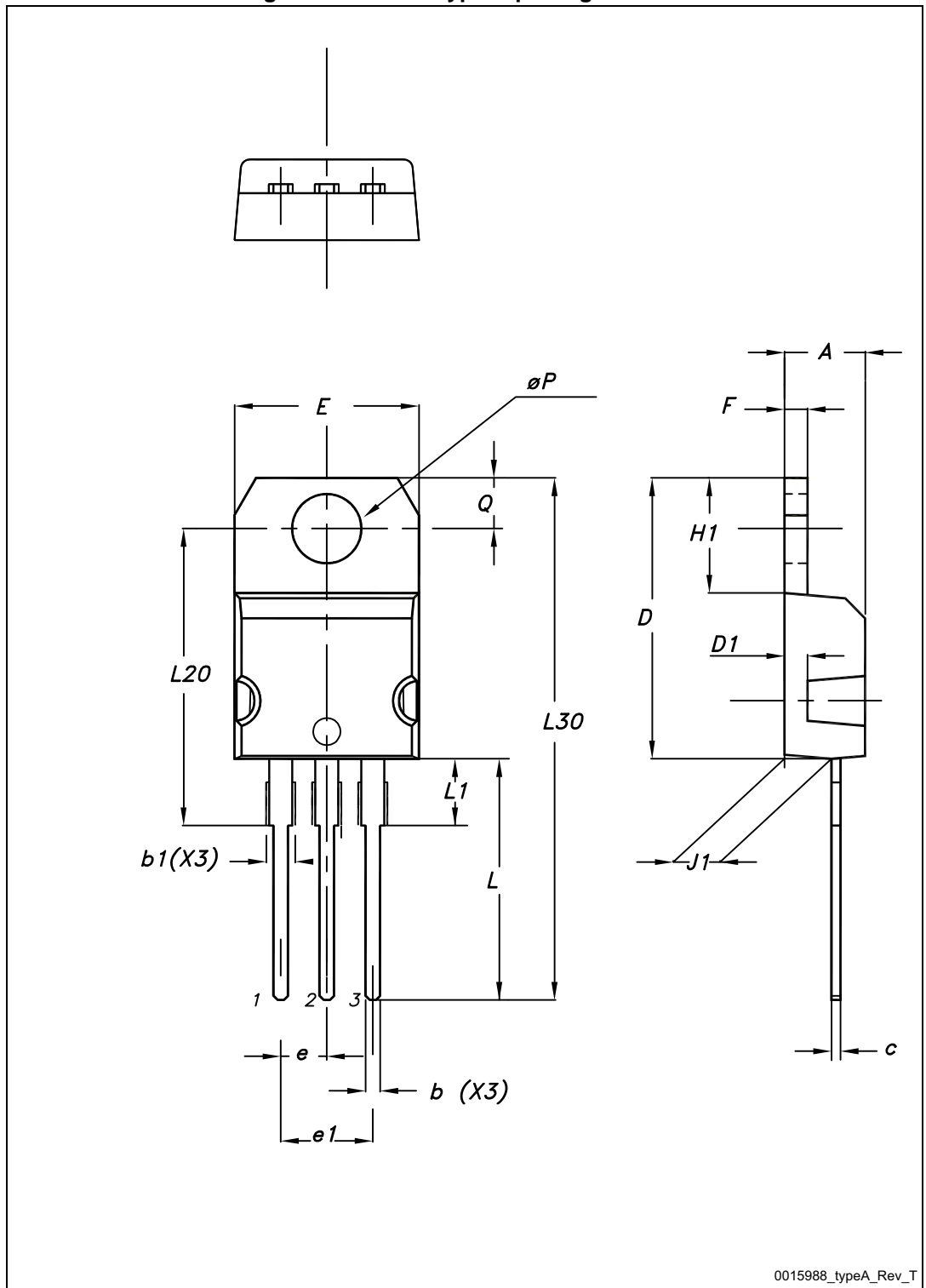
7012510_Rev_K_B

Table 14. 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

4.6 TO-220 type A package information

Figure 32. TO-220 type A package outline



0015988_typeA_Rev_T

Table 15. 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

5 Revision history

Table 16. 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 information and Section 4: Package information . Minor text changes.
16-Apr-2015	6	Throughout document: – added DPAK package information – text and formatting updates Updated Figure 1: Internal schematic diagram Updated Table 2: Absolute maximum ratings Updated Table 3: Thermal data Updated and renamed Table 5: Static (was On/off states)

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2015 STMicroelectronics – All rights reserved

