

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

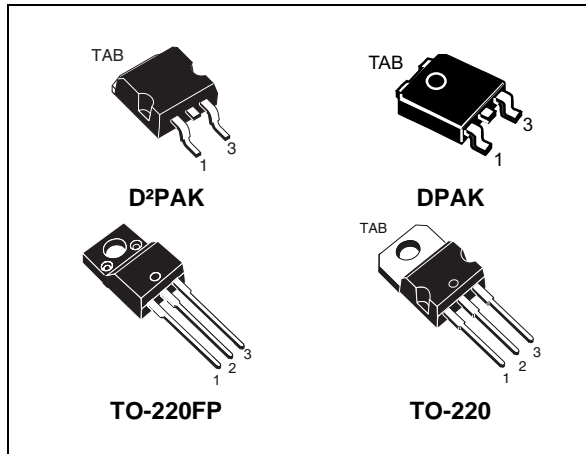
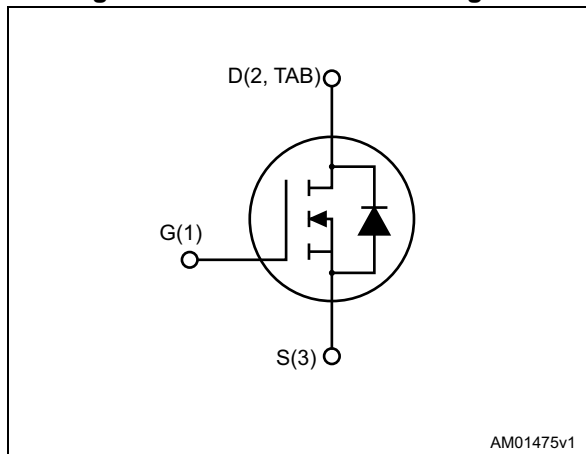


Figure 1. Internal schematic diagram



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	

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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

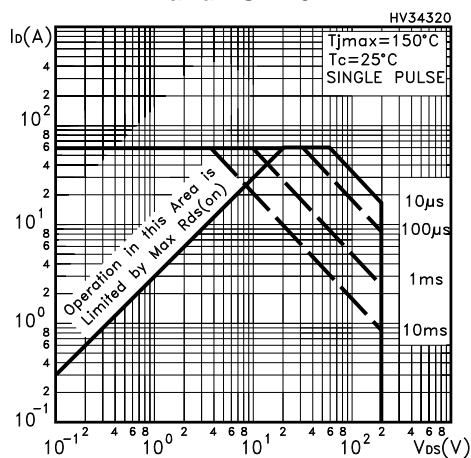


Figure 3. Thermal impedance for D²PAK, DPAK and TO-220

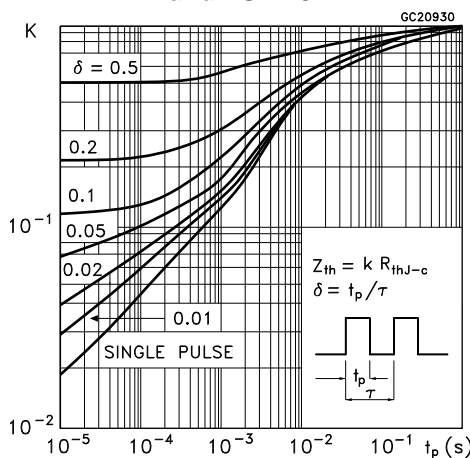


Figure 4. Safe operating area for TO-220FP

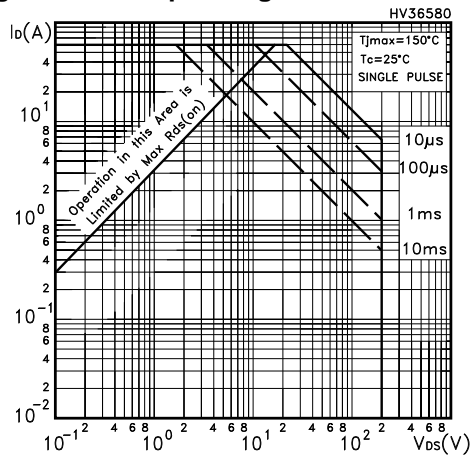


Figure 5. Thermal impedance for TO-220FP

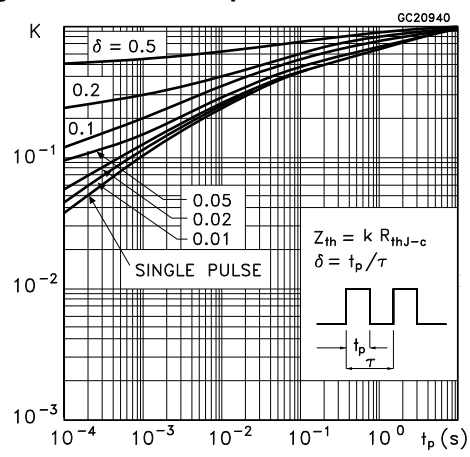


Figure 6. Output characteristics

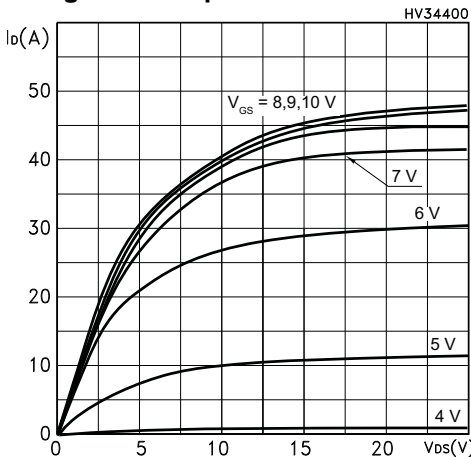


Figure 7. Transfer characteristics

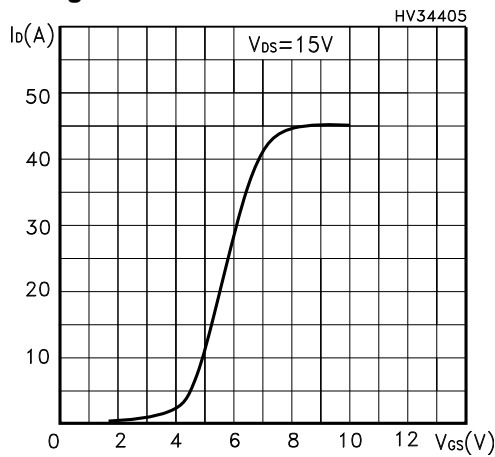


Figure 8. Static drain-source on-resistance

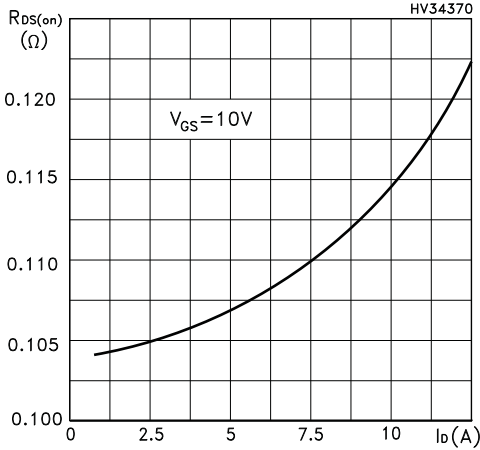


Figure 9. Normalized $V_{(BR)DSS}$ vs temperature

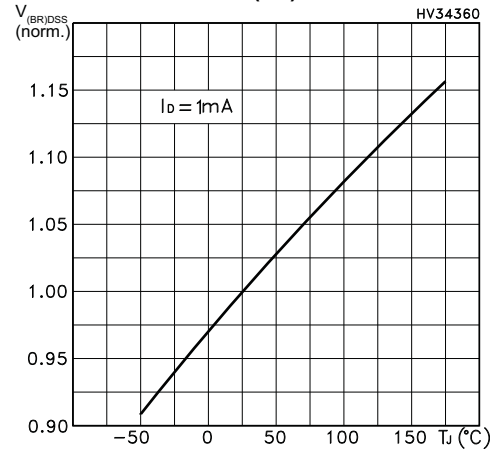


Figure 10. Gate charge vs gate-source voltage

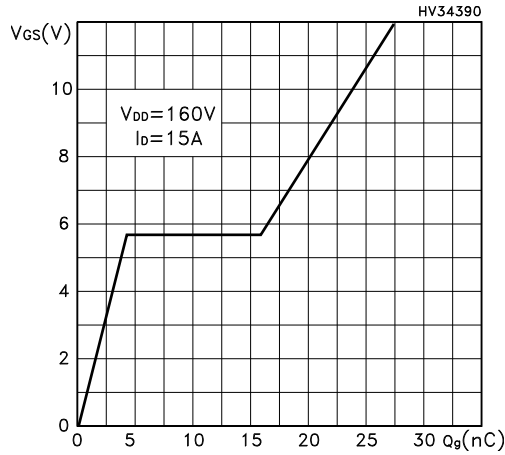


Figure 11. Capacitance variations

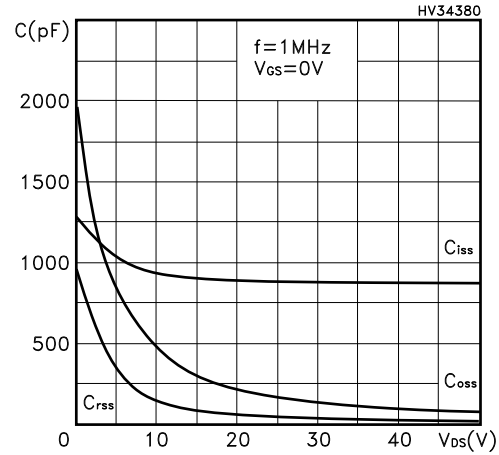


Figure 12. Normalized gate threshold voltage vs temperature

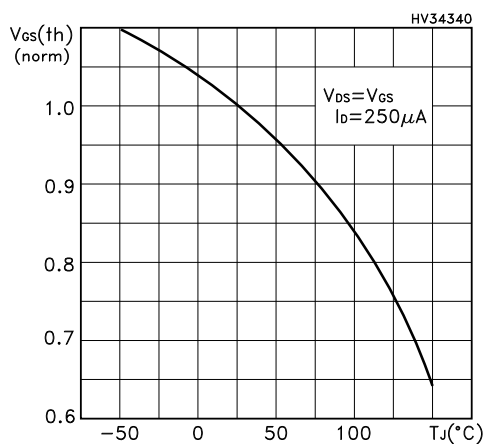


Figure 13. Normalized on-resistance vs temperature

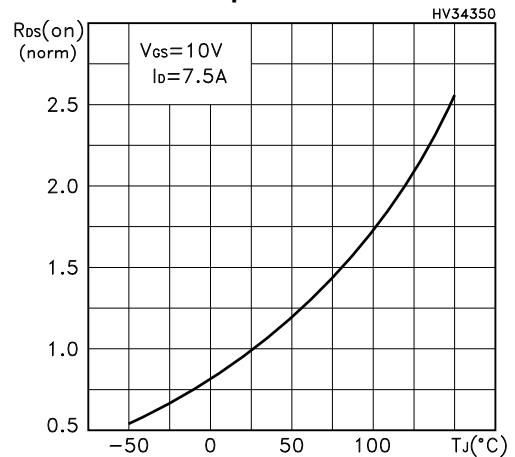


Figure 14. Source-drain forward characteristics

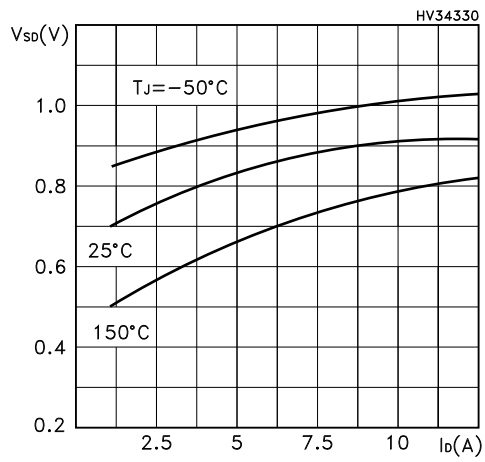
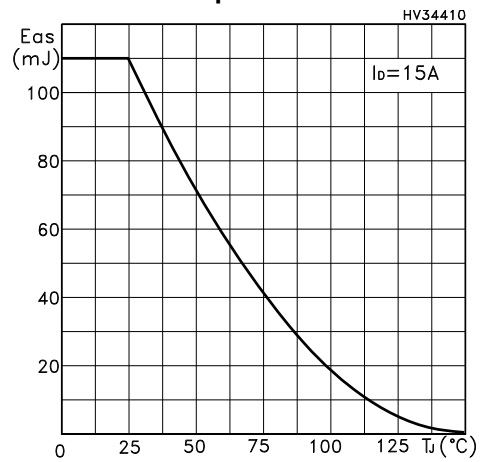
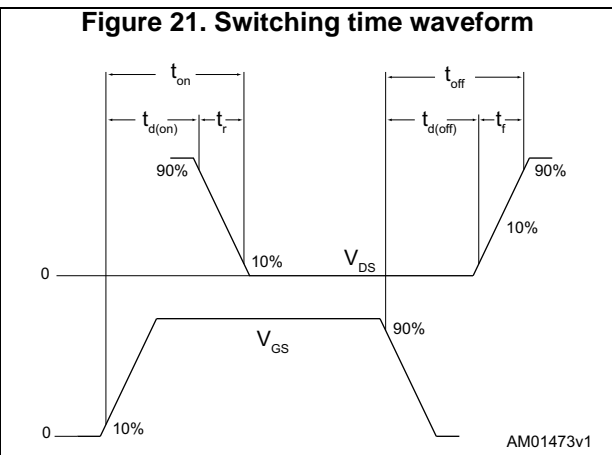
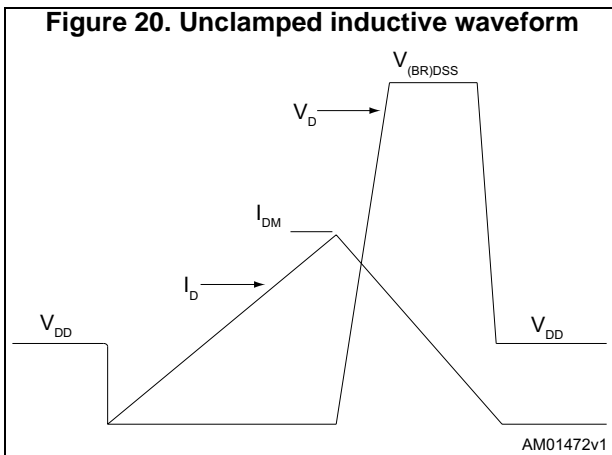
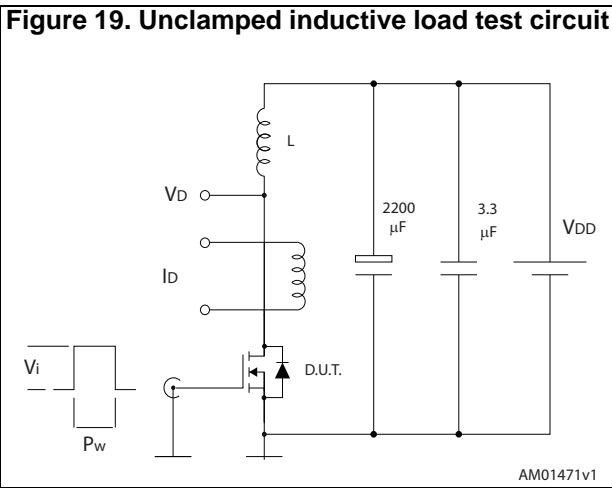
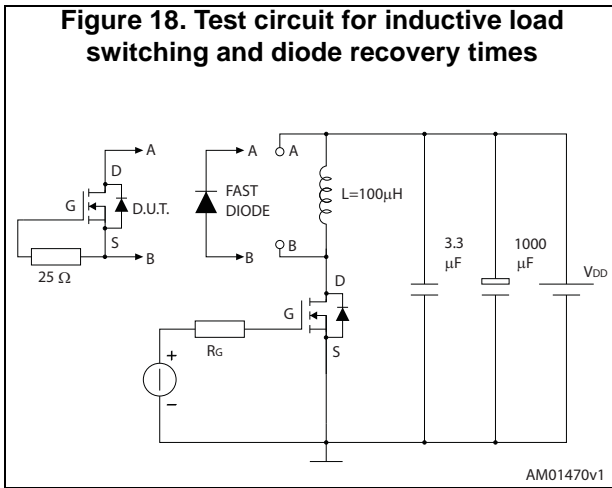
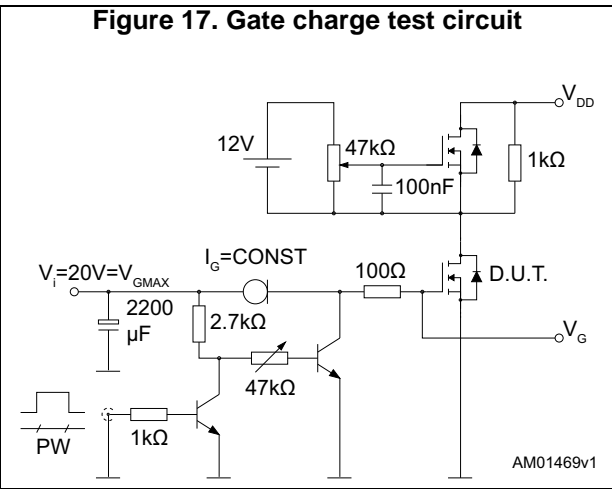
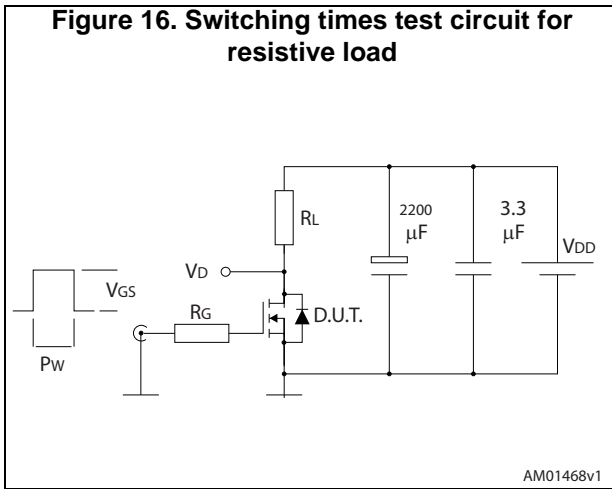


Figure 15. Maximum avalanche energy vs temperature



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

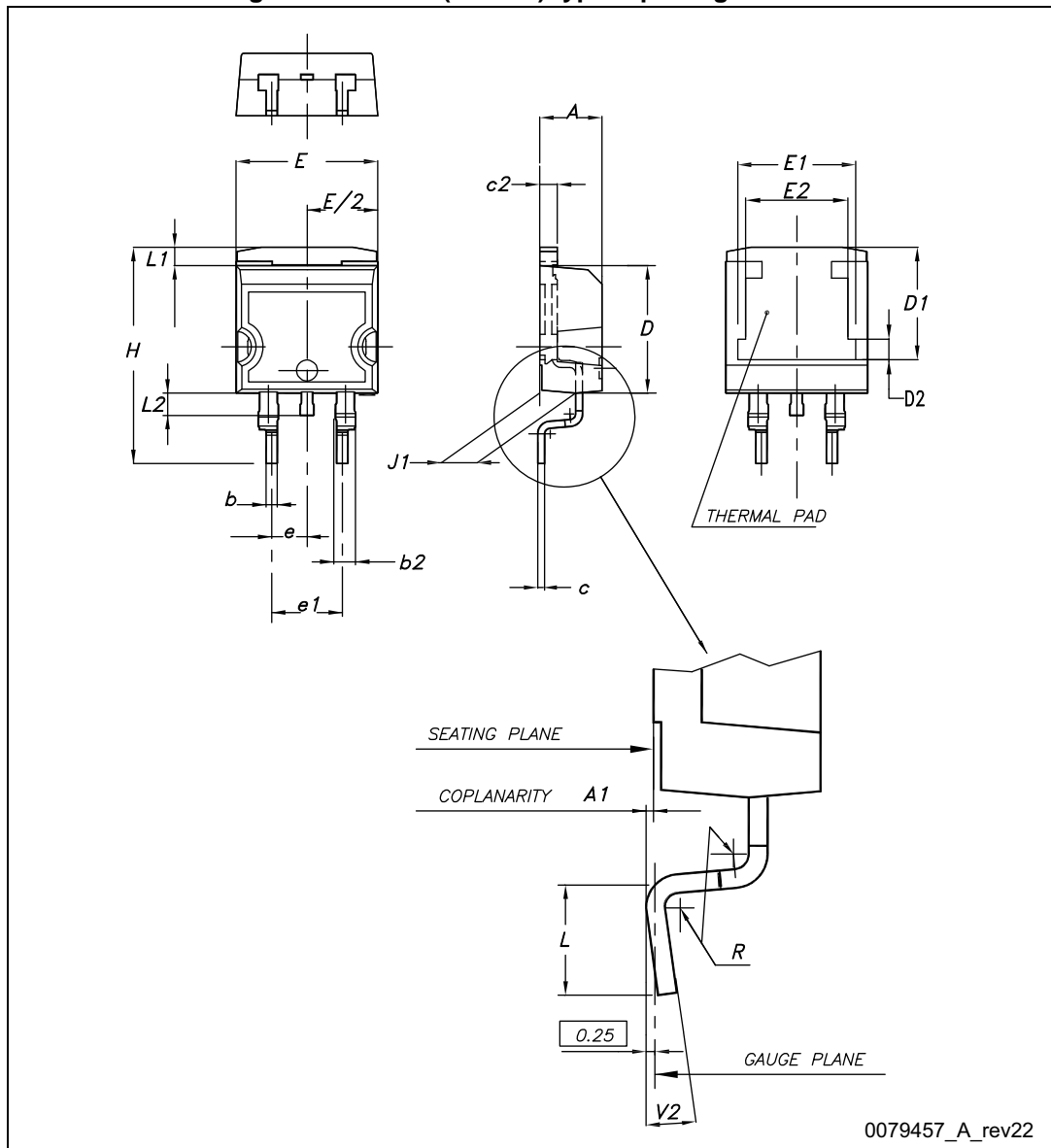


Table 9. D²PAK (TO-263) type A mechanical data

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

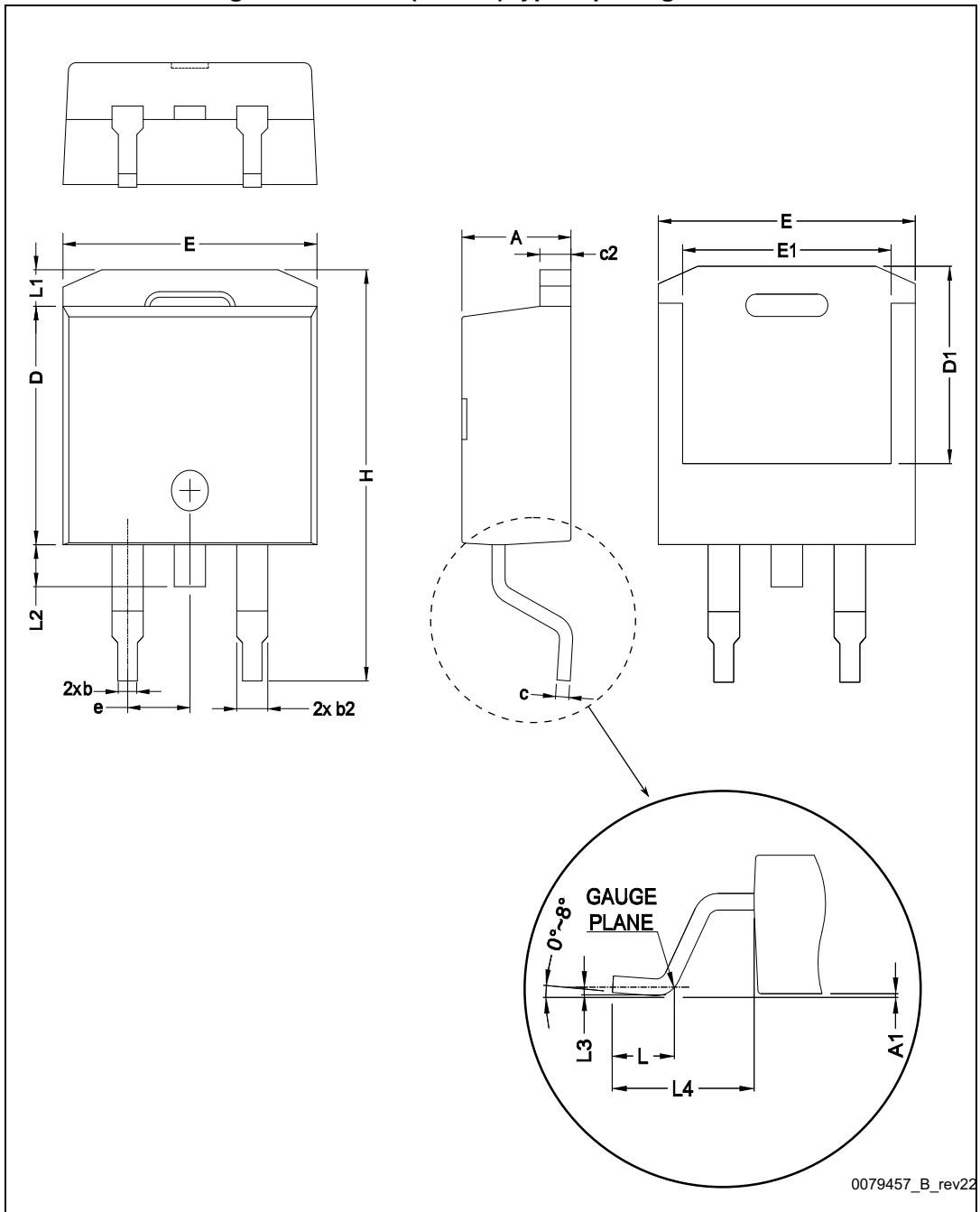
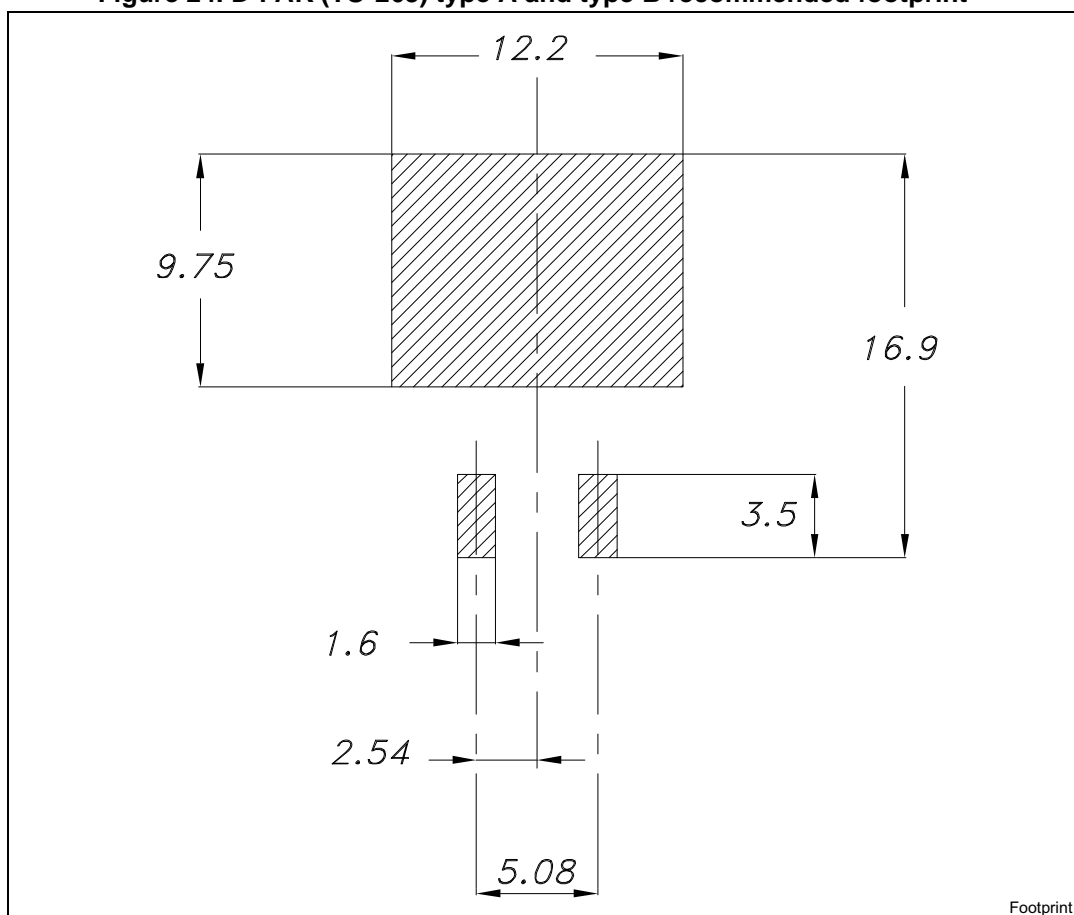


Table 10. D²PAK (TO-263) type B mechanical data

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)



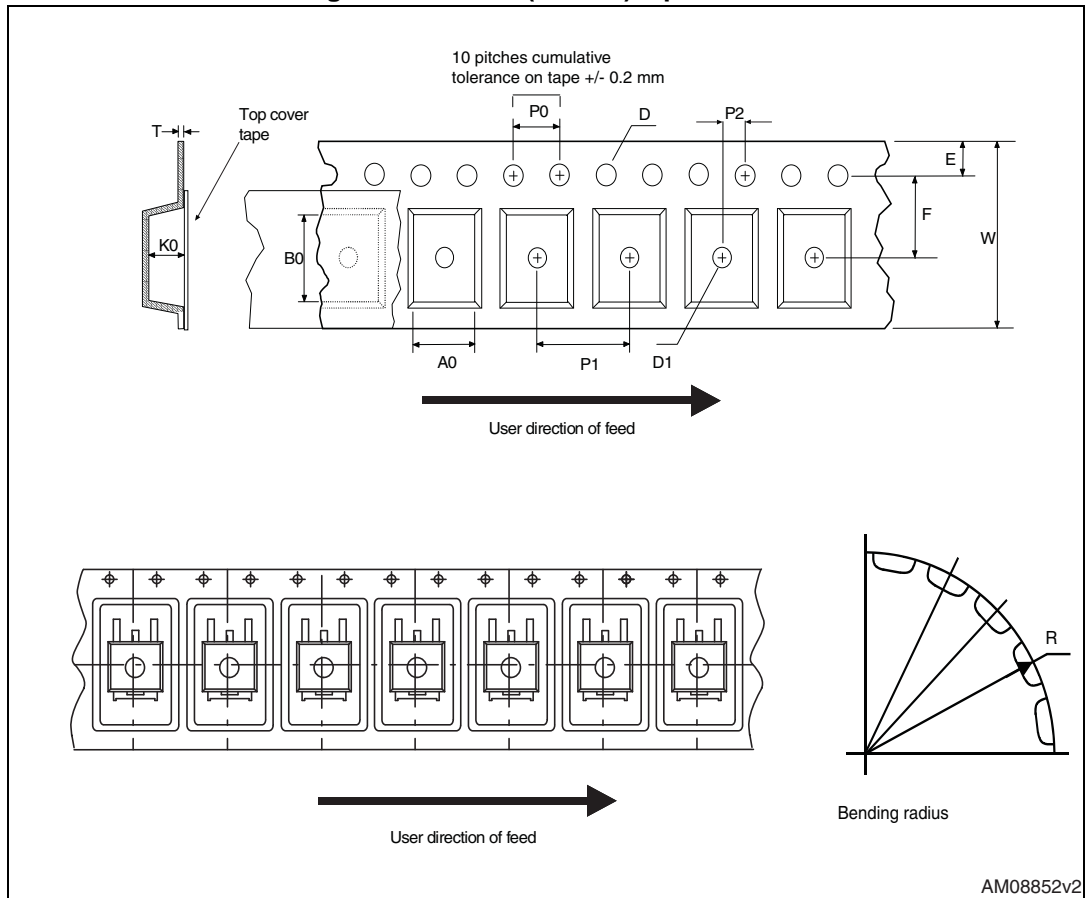
a. All dimension are in millimeters

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

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

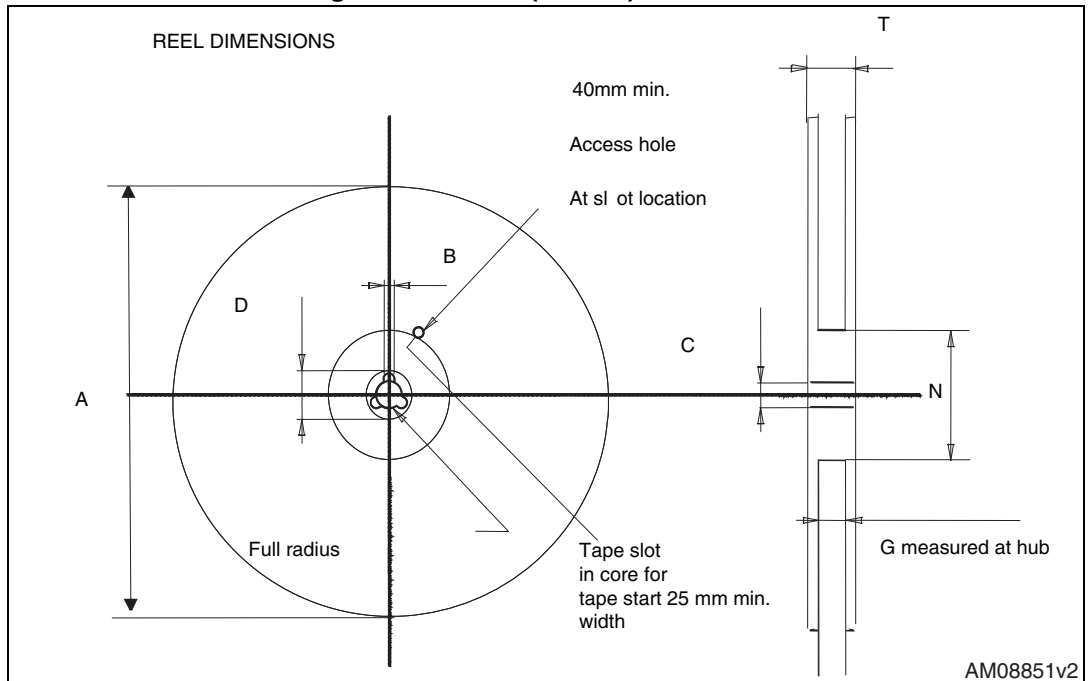
Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1		Base qty.	1000
P2	1.9	2.1		Bulk qty.	1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Figure 25. D²PAK (TO-263) tape outline



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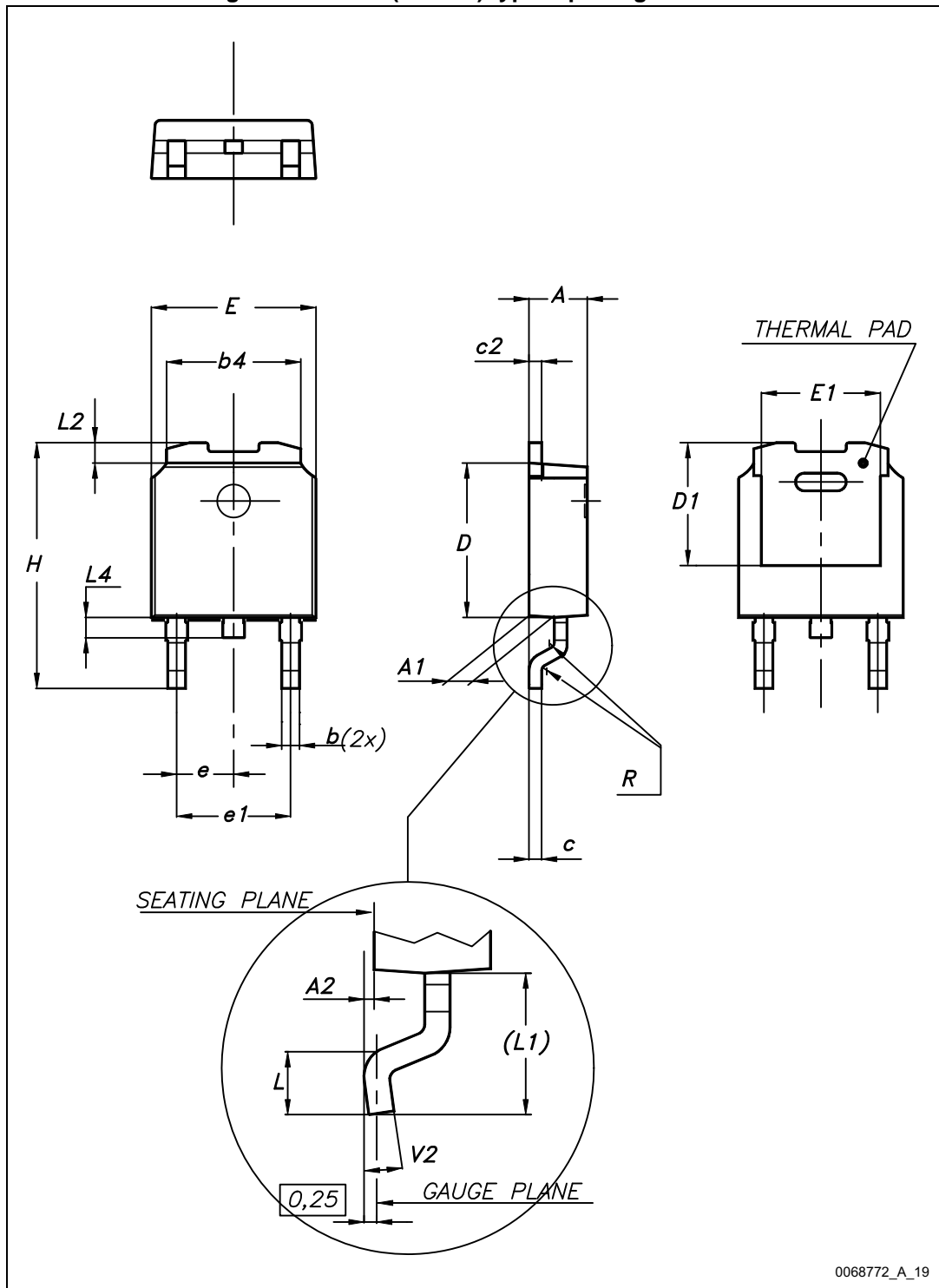
Figure 26. D²PAK (TO-263) reel outline



AM08851v2

4.3 DPAK (TO-252) package information

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

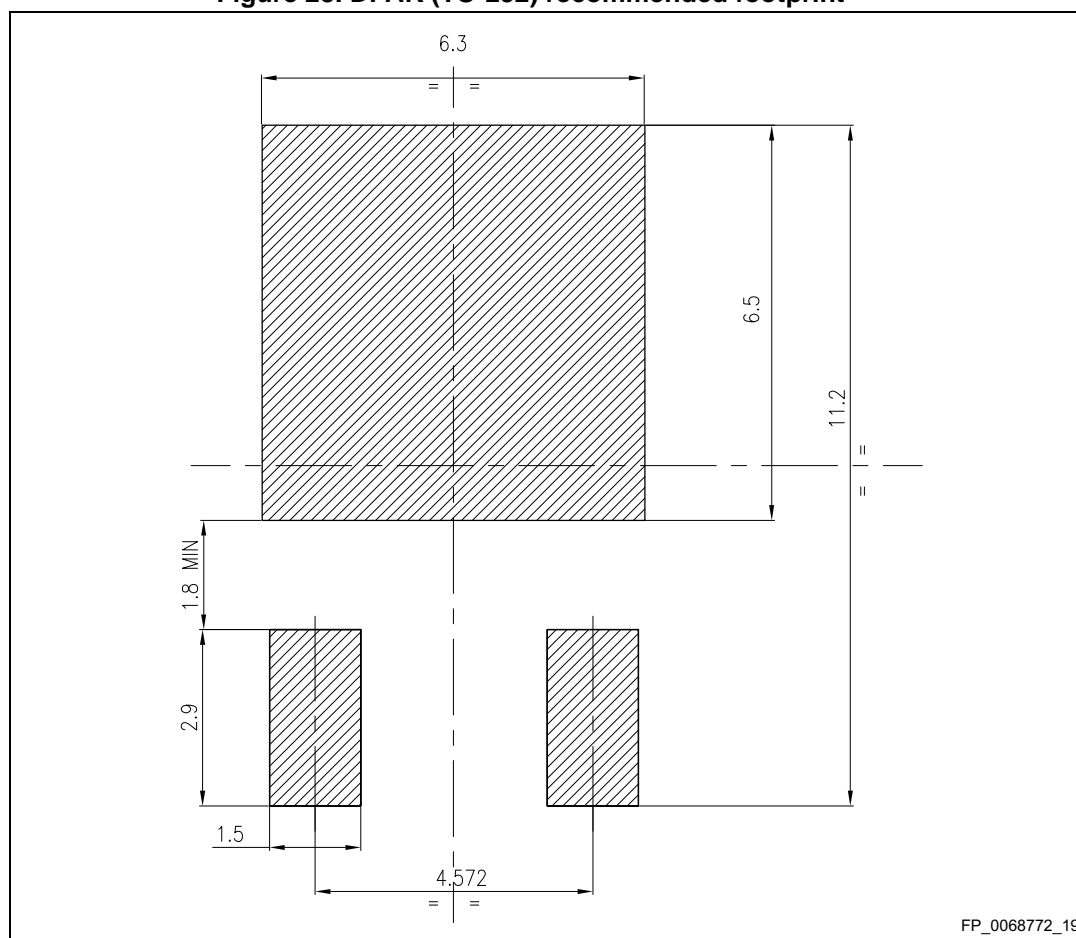


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Table 12. DPAK (TO-252) type A mechanical data

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

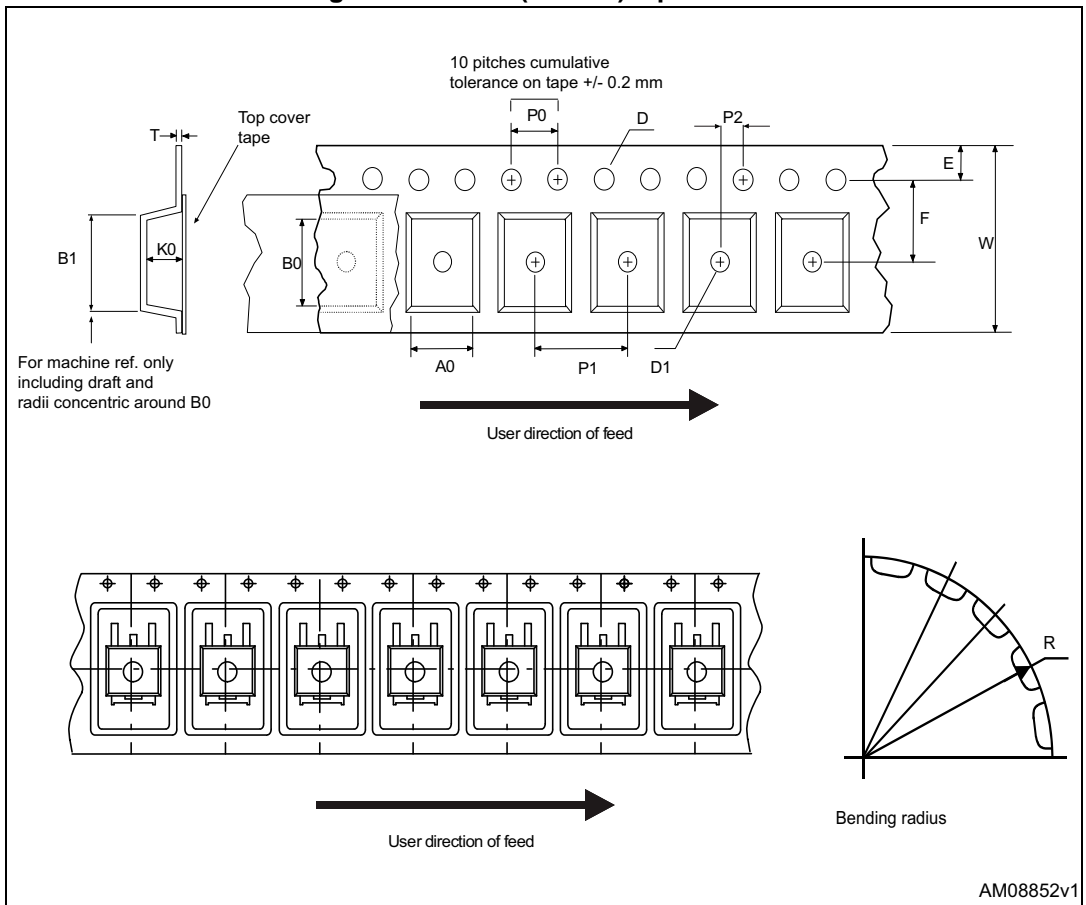


Figure 30. DPAK (TO-252) reel outline

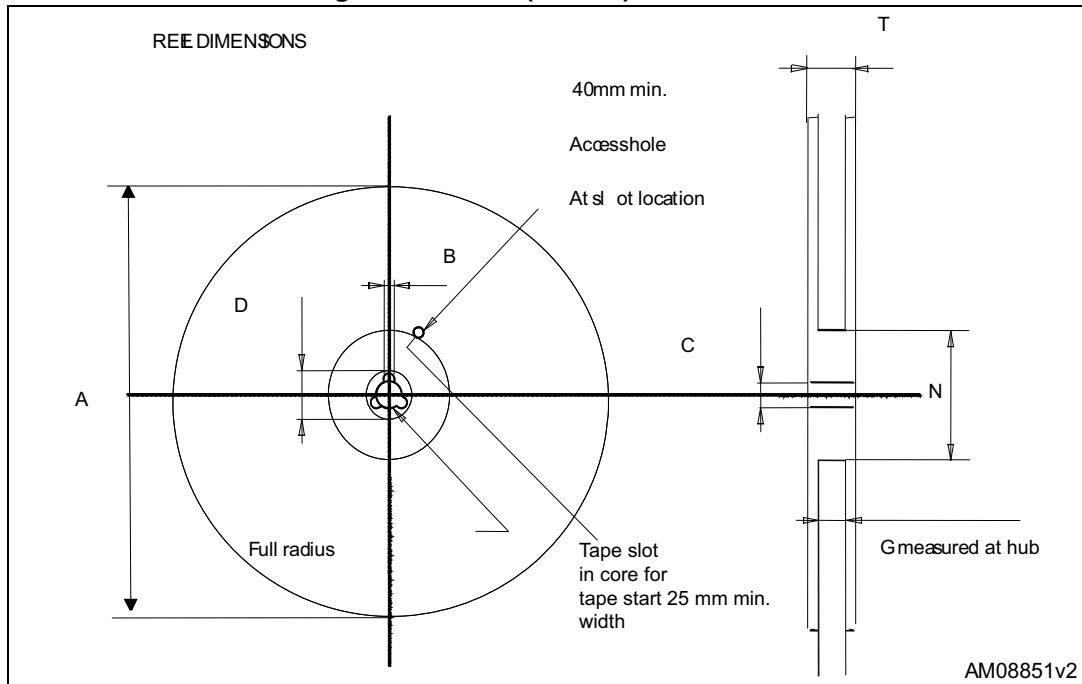
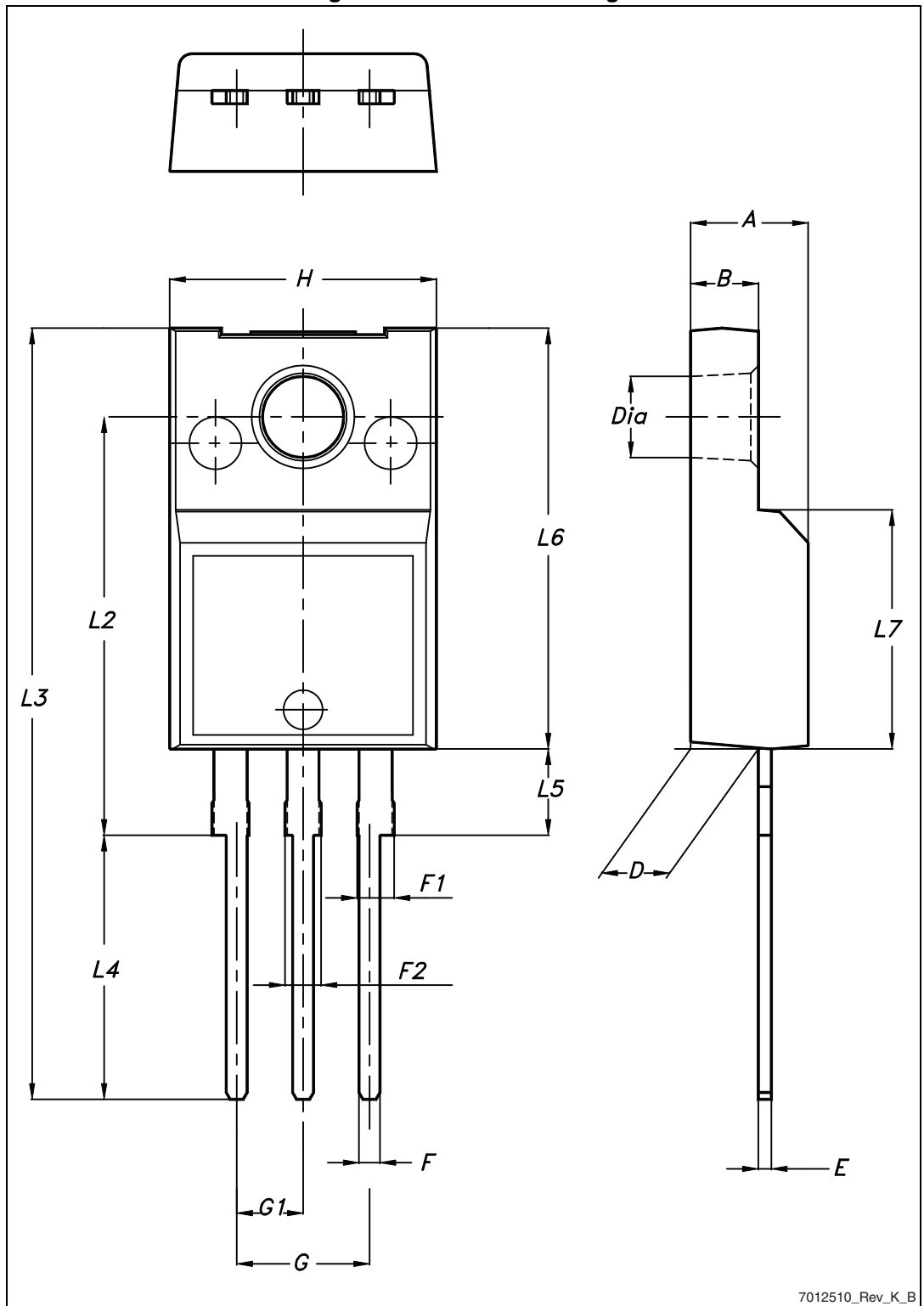


Table 13. DPAK (TO-252) tape and reel mechanical data

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



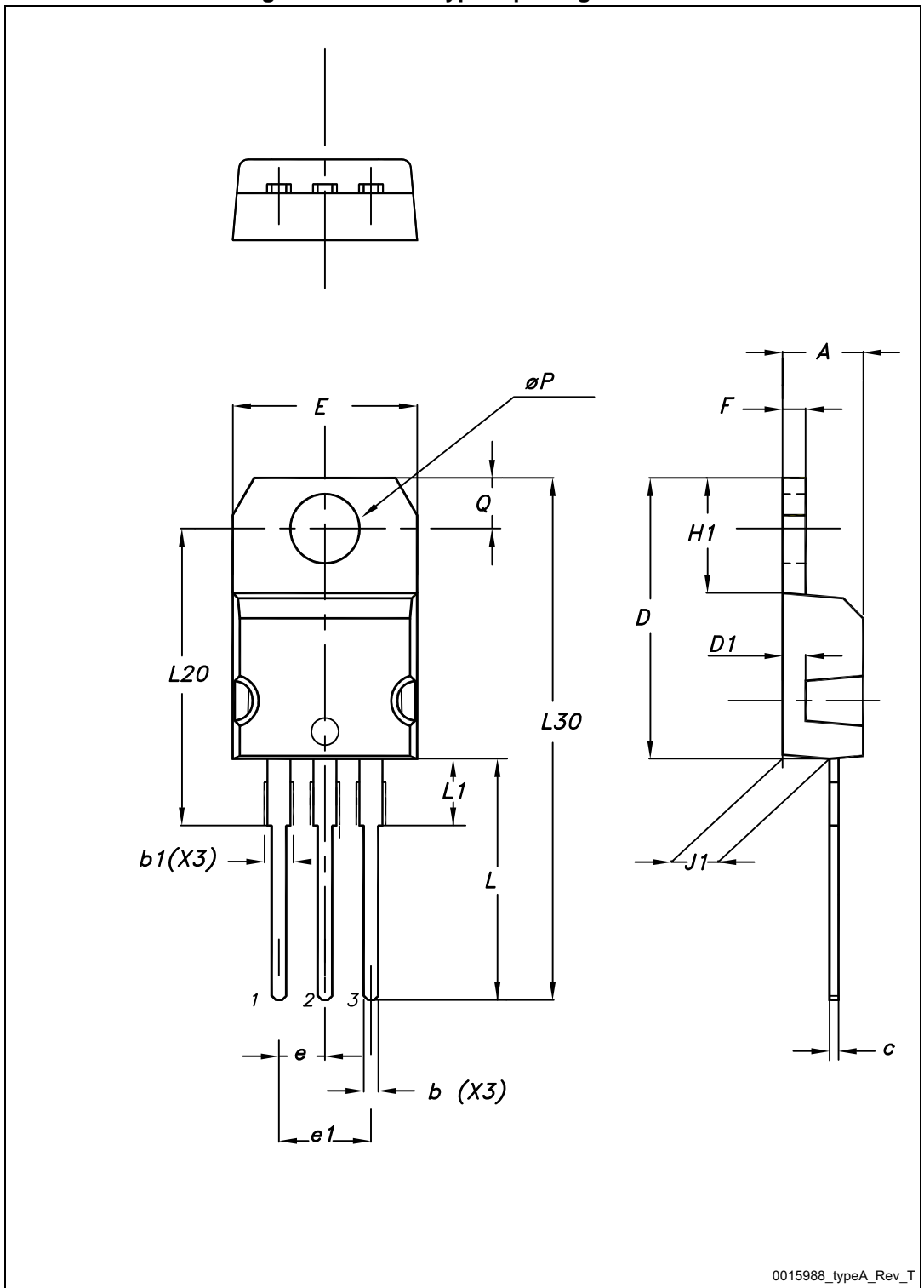
7012510_Rev_K_B

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)

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