STB19NF20, STD19NF20, STF19NF20, STP19NF20

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

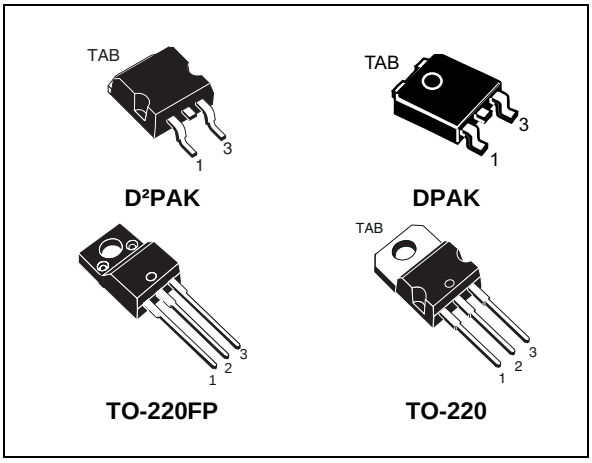
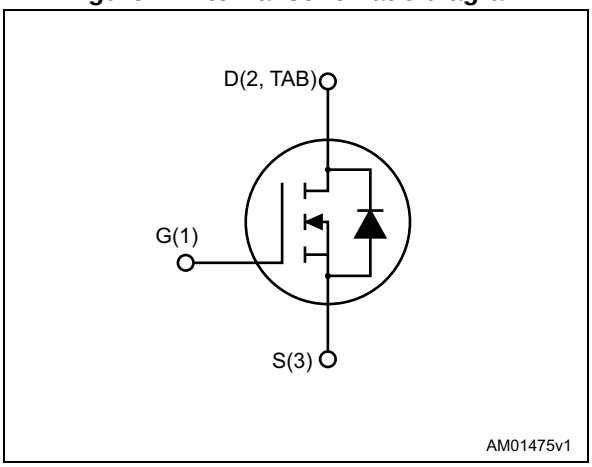


Figure 1. Internal schematic diagram



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^2PAK	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
		D²PAK, 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			

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

Table 3. Thermal data

Symbol	Parameter	Value				Unit
		D²PAK	DPAK	TO-220	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case	1.39			5	°C/W
$R_{thj\text{-}pcb}$	Thermal resistance junction-pcb	35	50			
$R_{thj\text{-}a}$	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 °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 mA, V_{GS} = 0 V	200			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 200 V			1	µA
		V_{GS} = 0 V, V_{DS} = 200 V, T_C = 125 °C			10	
I_{GSS}	Gate body leakage current	V_{DS} = 0 V, V_{GS} = ±20 V			±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 = 7.5 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 V, I_D = 7.5 A		12		S
C_{iss}	Input capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0 V		800		pF
C_{oss}	Output capacitance			165		
C_{rss}	Reverse transfer capacitance			26		
Q_g	Total gate charge	V_{DD} = 160 V, I_D = 15 A, V_{GS} = 10 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 V, I_D = 7.5 A, R_G = 4.7 Ω, V_{GS} = 10 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 A, V_{GS} = 0 V			1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 15 A, V_{DD} = 50 V di/dt = 100 A/µs, *(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 A, V_{DD} = 50 V di/dt = 100 A/µs, T_j = 150 °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

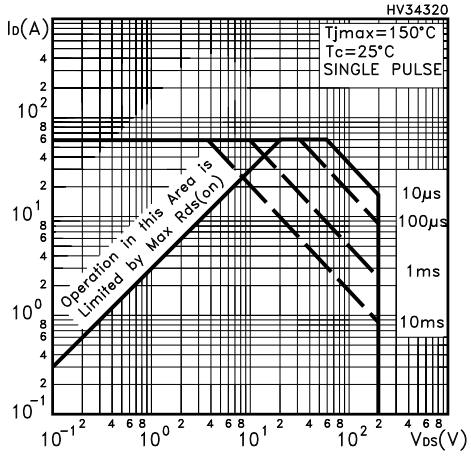


Figure 3. Thermal impedance for D²PAK, DPAK and TO-220

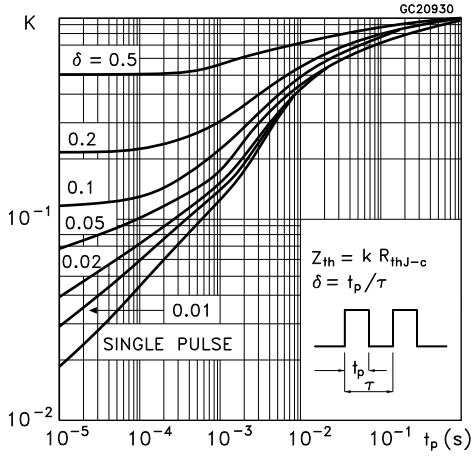


Figure 4. Safe operating area for TO-220FP

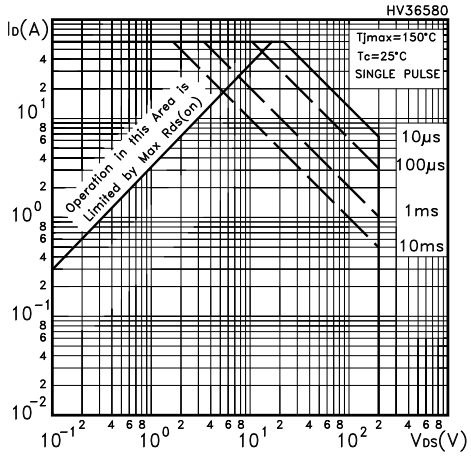


Figure 5. Thermal impedance for TO-220FP

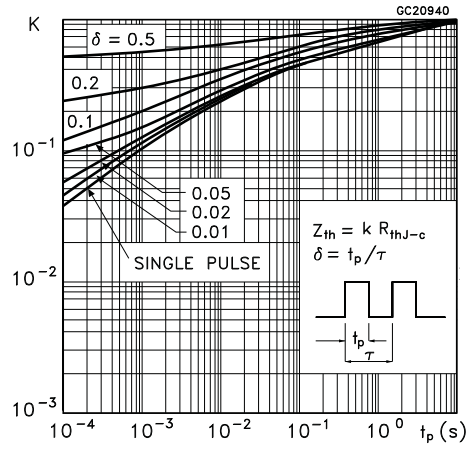


Figure 6. Output characteristics

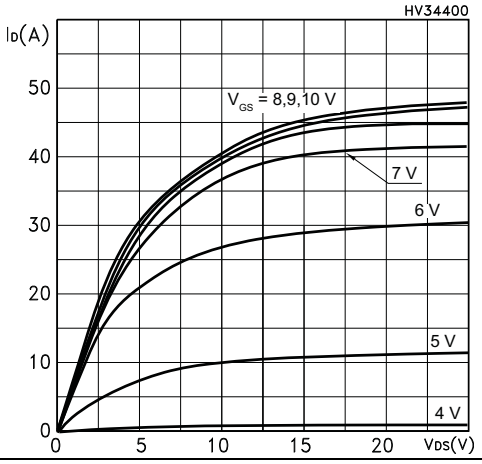


Figure 7. Transfer characteristics

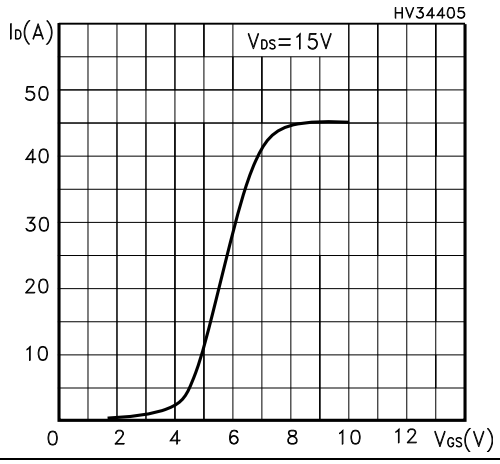


Figure 8. Static drain-source on-resistance

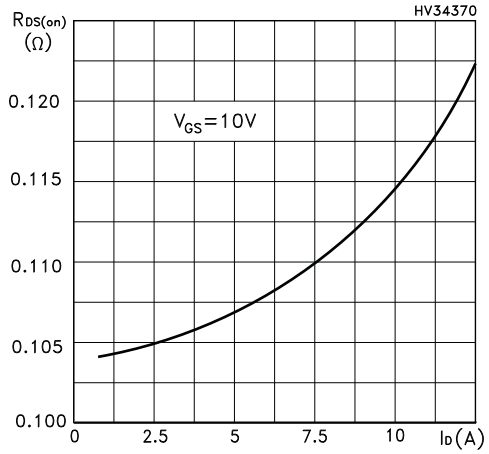


Figure 9. Normalized $V_{(BR)DSS}$ vs temperature

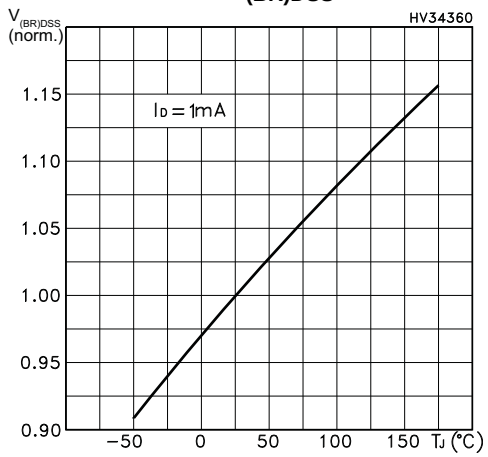


Figure 10. Gate charge vs gate-source voltage

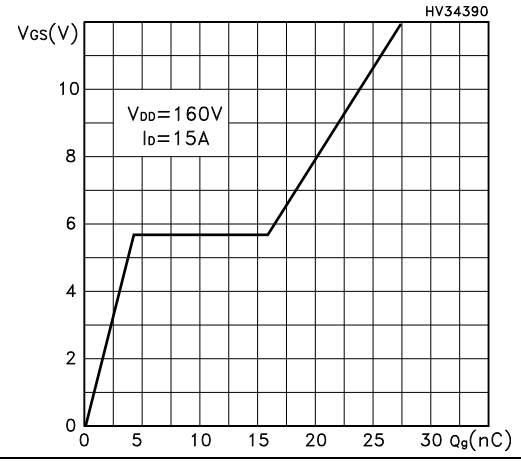


Figure 11. Capacitance variations

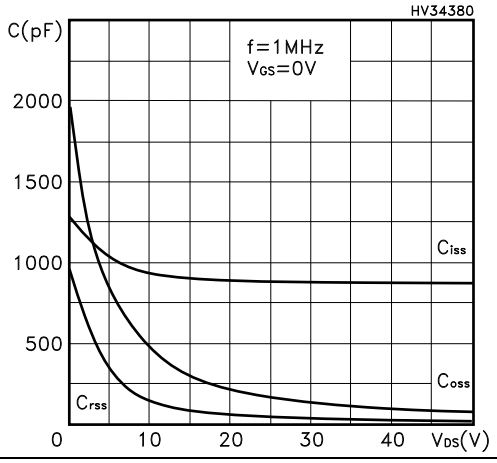


Figure 12. Normalized gate threshold voltage vs temperature

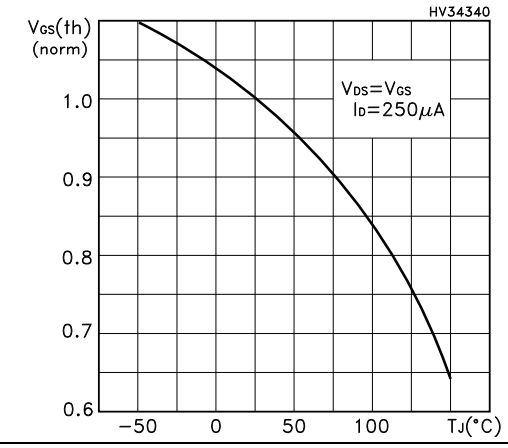


Figure 13. Normalized on-resistance vs temperature

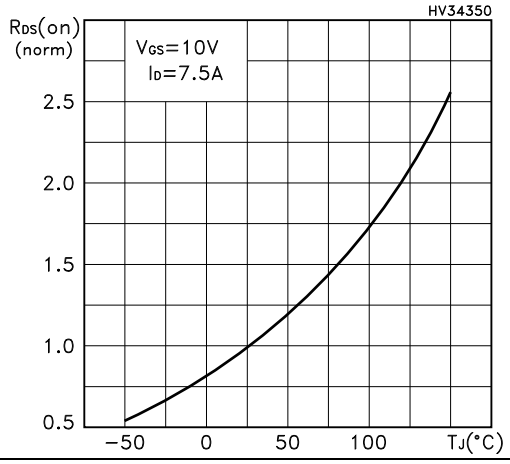


Figure 14. Source-drain forward characteristics

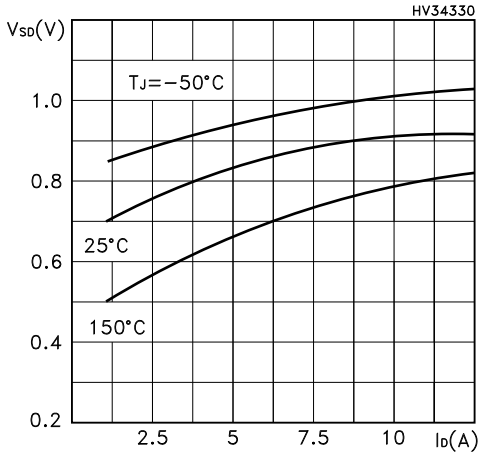
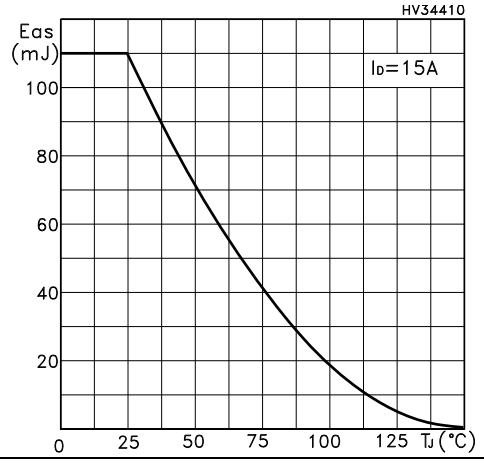


Figure 15. Maximum avalanche energy vs temperature



3 Test circuits

Figure 16. Switching times test circuit for resistive load

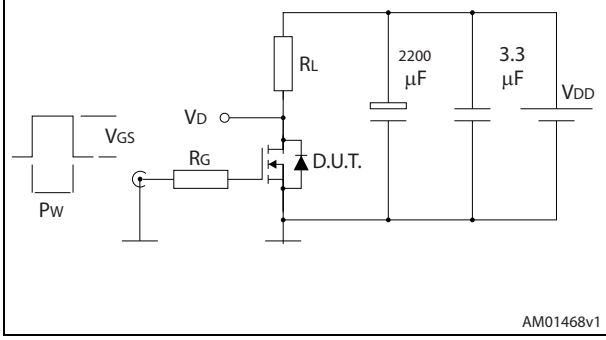


Figure 17. Gate charge test circuit

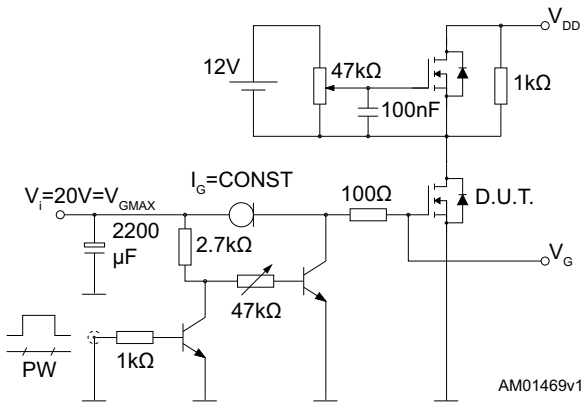


Figure 18. Test circuit for inductive load switching and diode recovery times

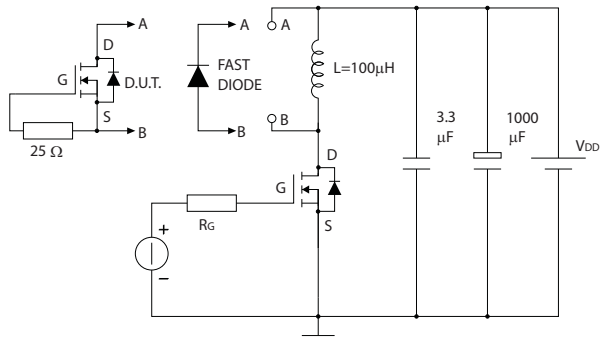


Figure 19. Unclamped inductive load test circuit

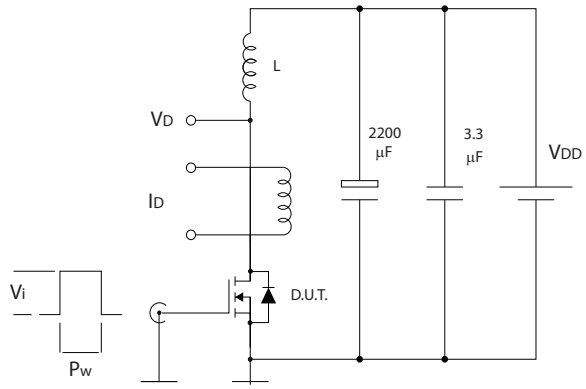


Figure 20. Unclamped inductive waveform

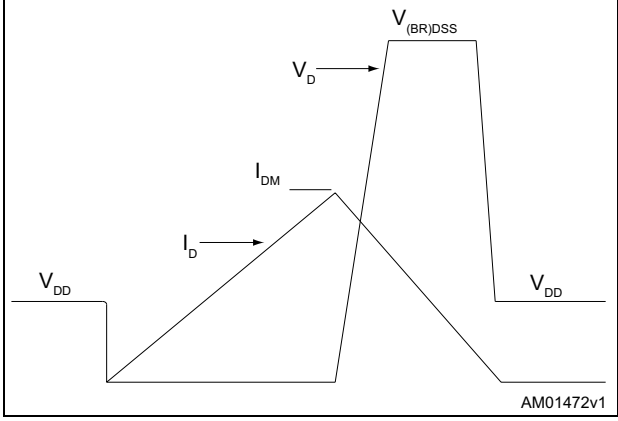
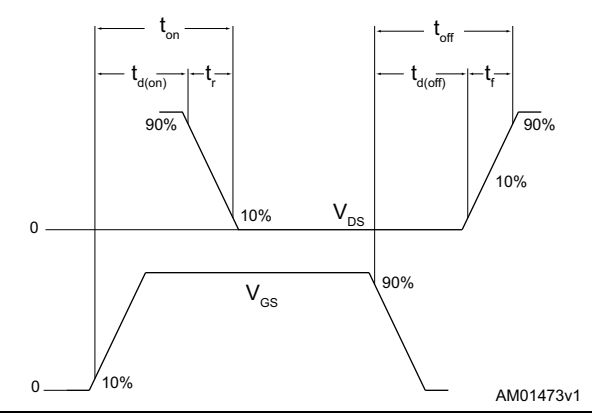


Figure 21. Switching time waveform



4 Package 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

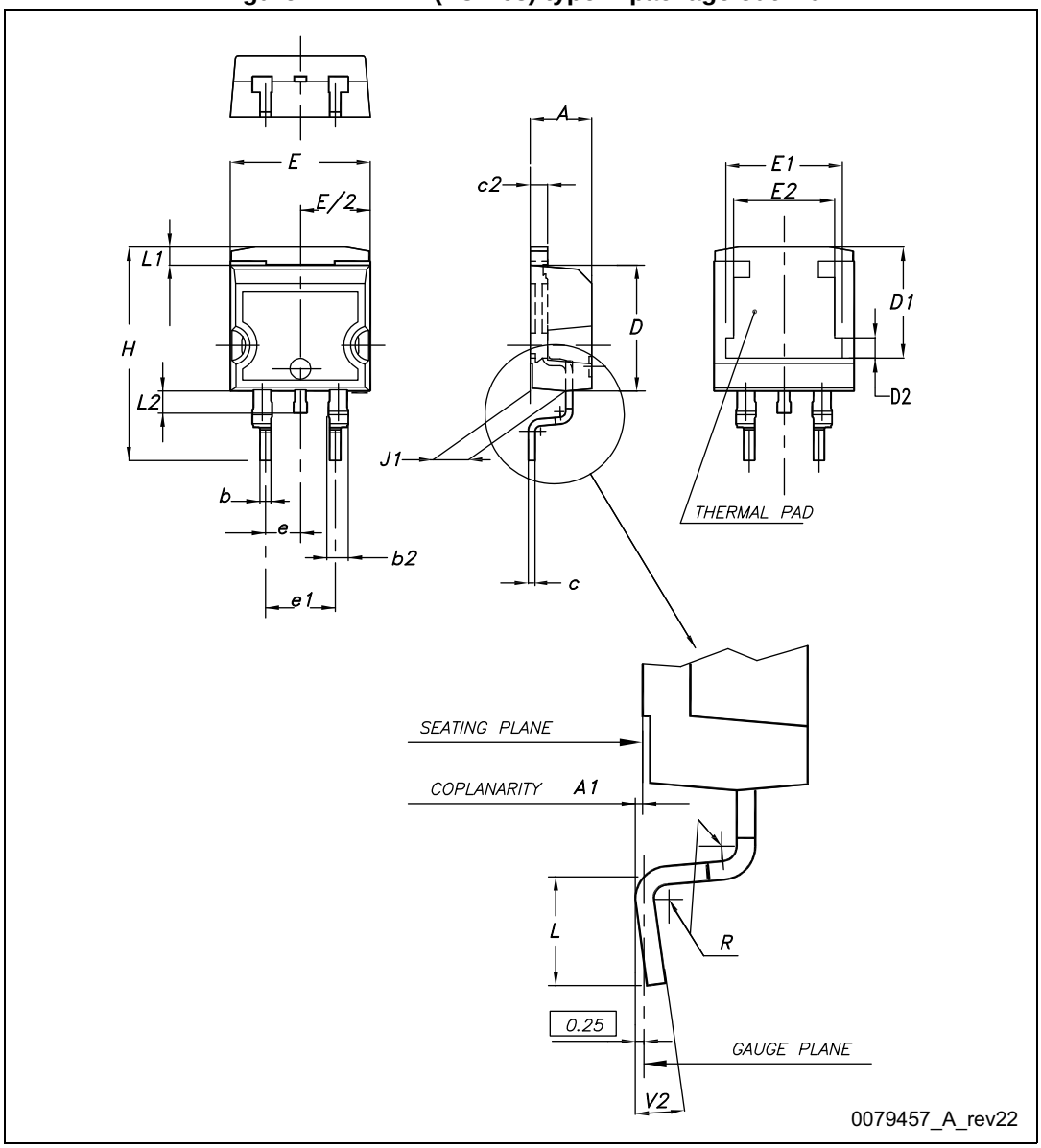


Table 9. D²PAK (TO-263) type A mechanical data

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

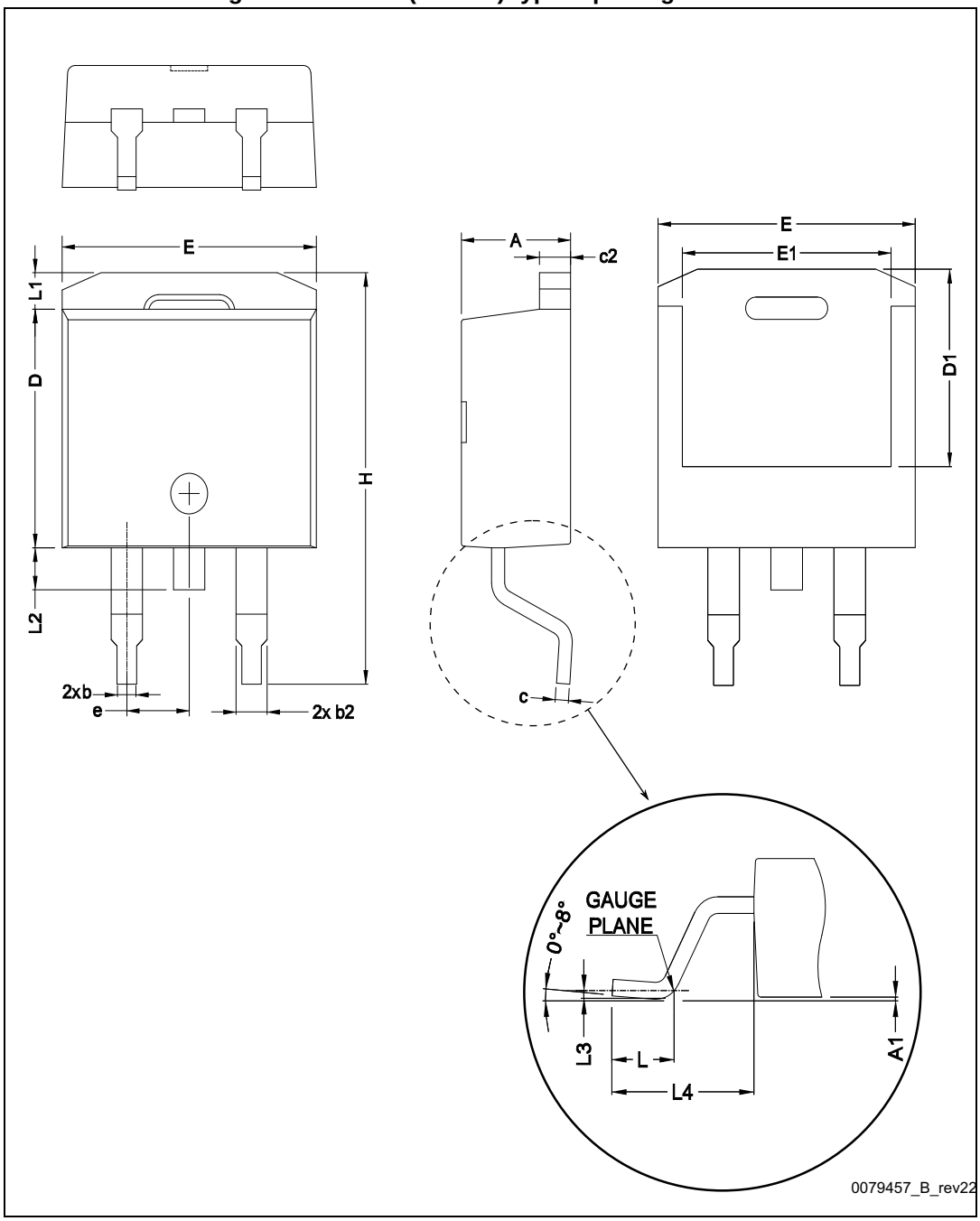
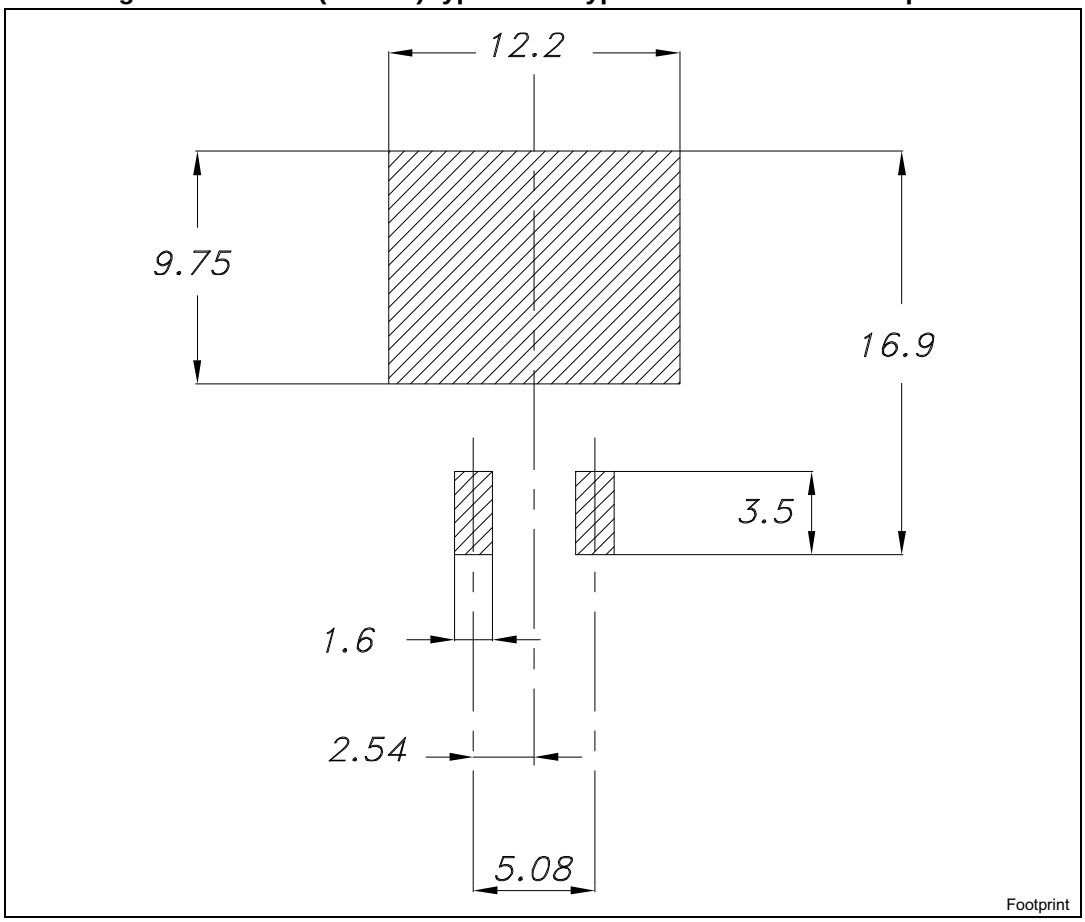


Table 10. D²PAK (TO-263) type B mechanical data

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

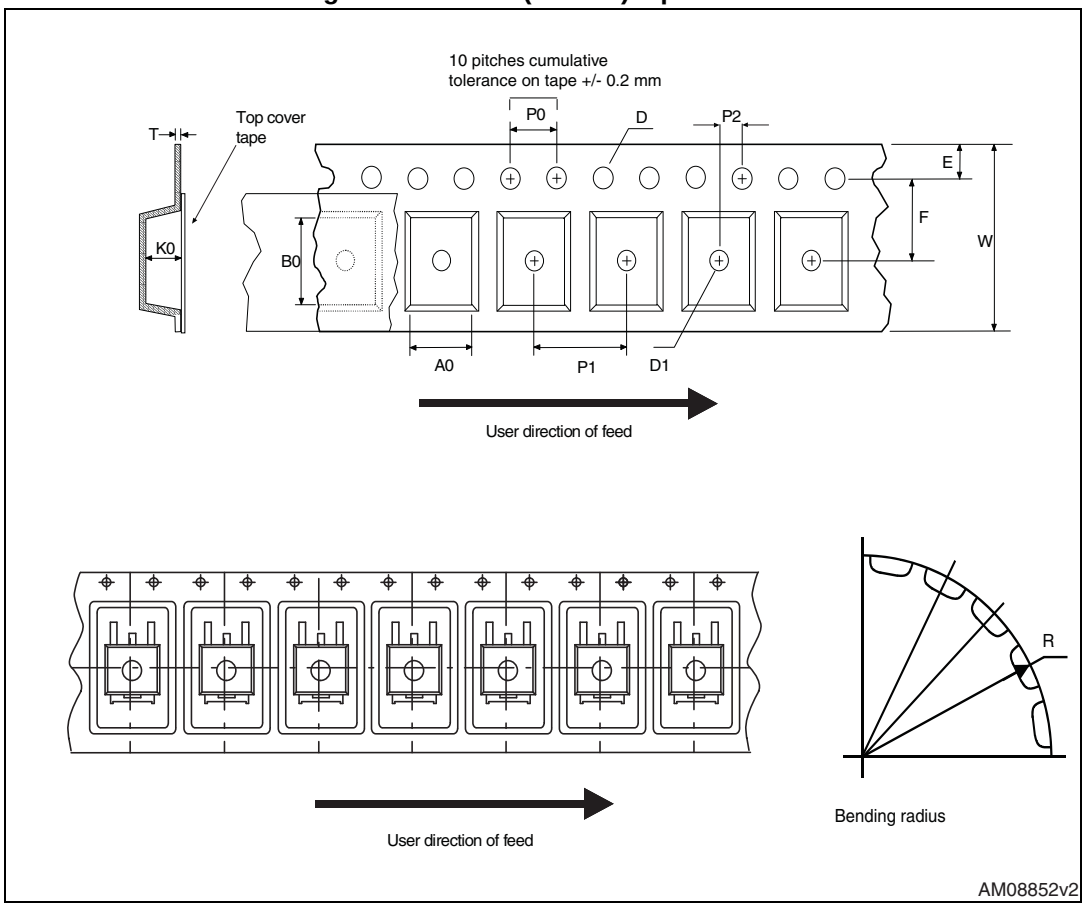
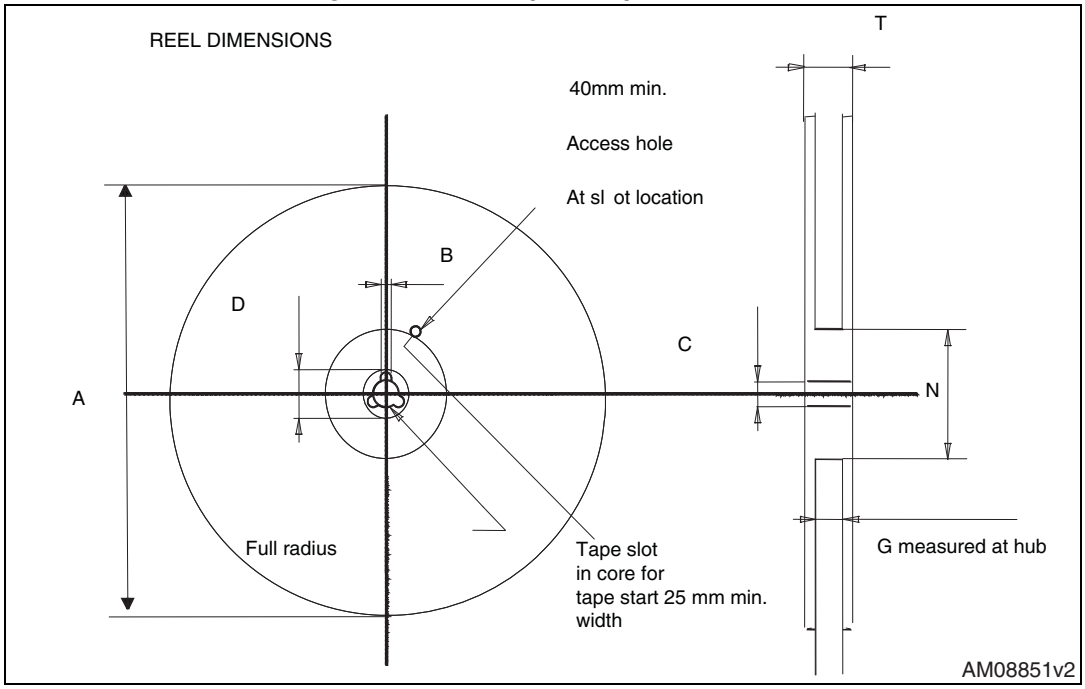


Figure 26. D²PAK (TO-263) reel outline



4.3 DPAK (TO-252) package information

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

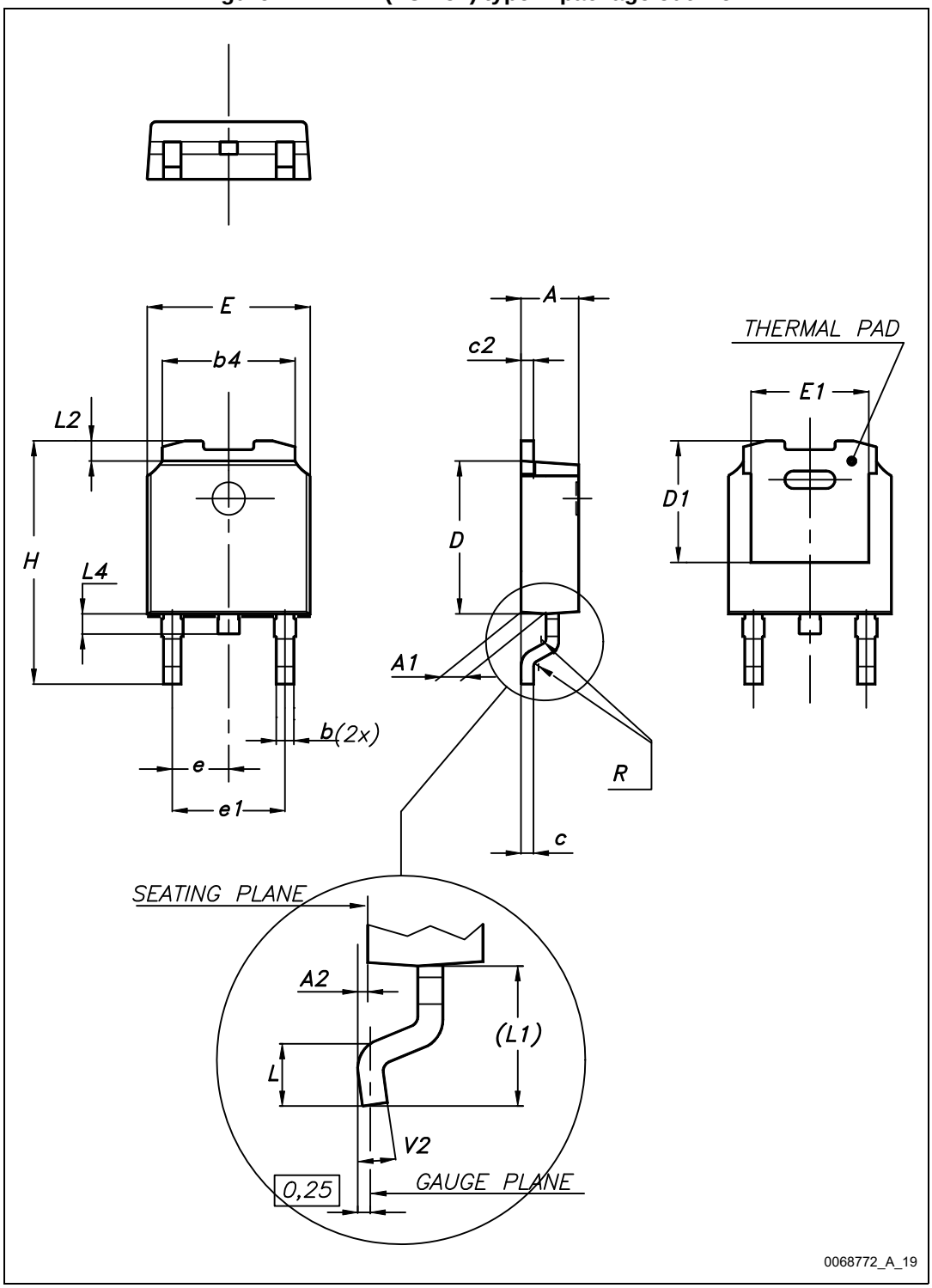
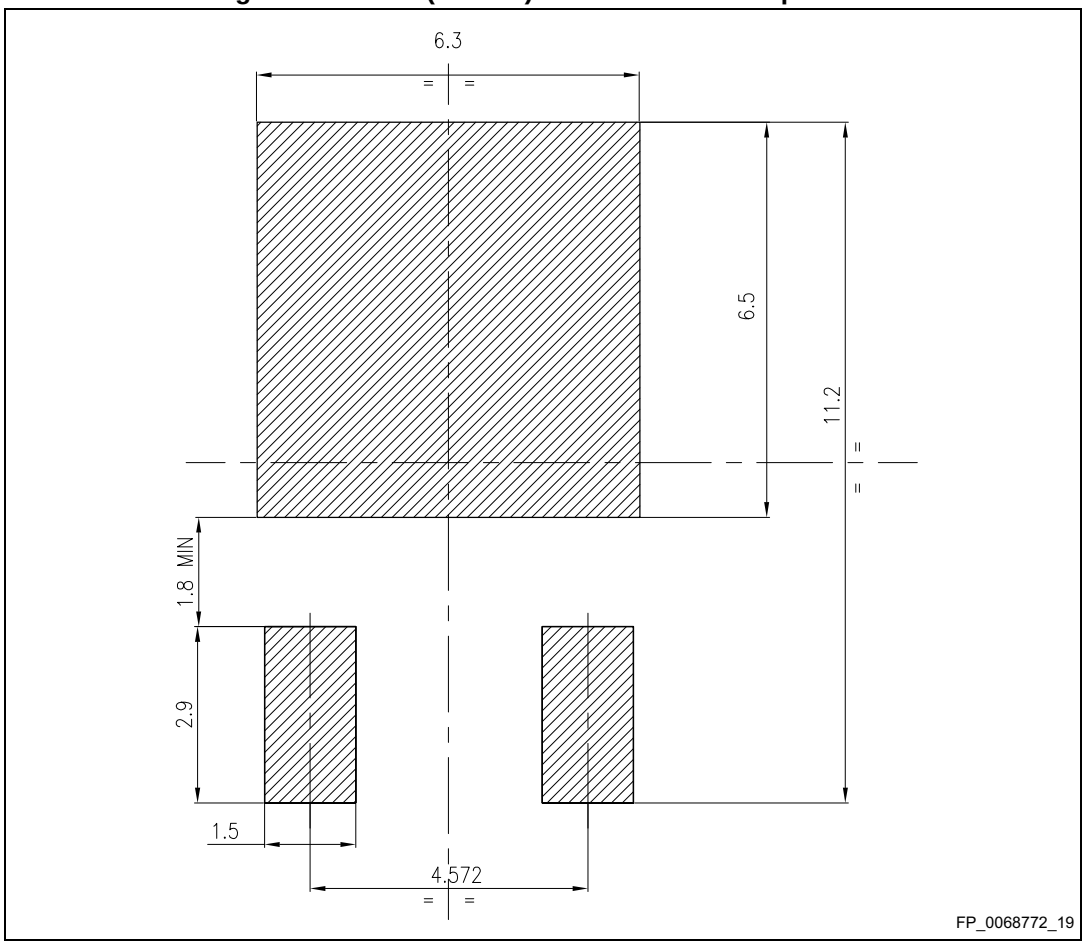


Table 12. DPAK (TO-252) type A mechanical data

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

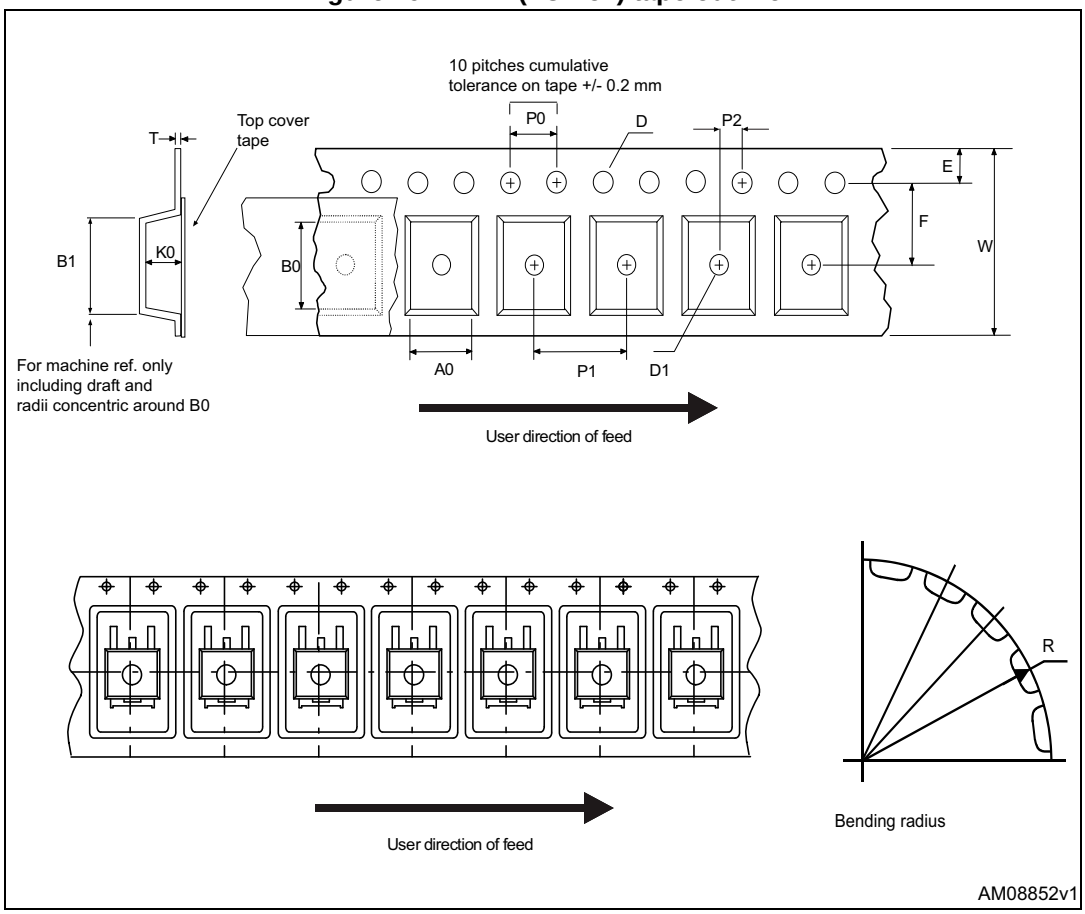


Figure 30. DPAK (TO-252) reel outline

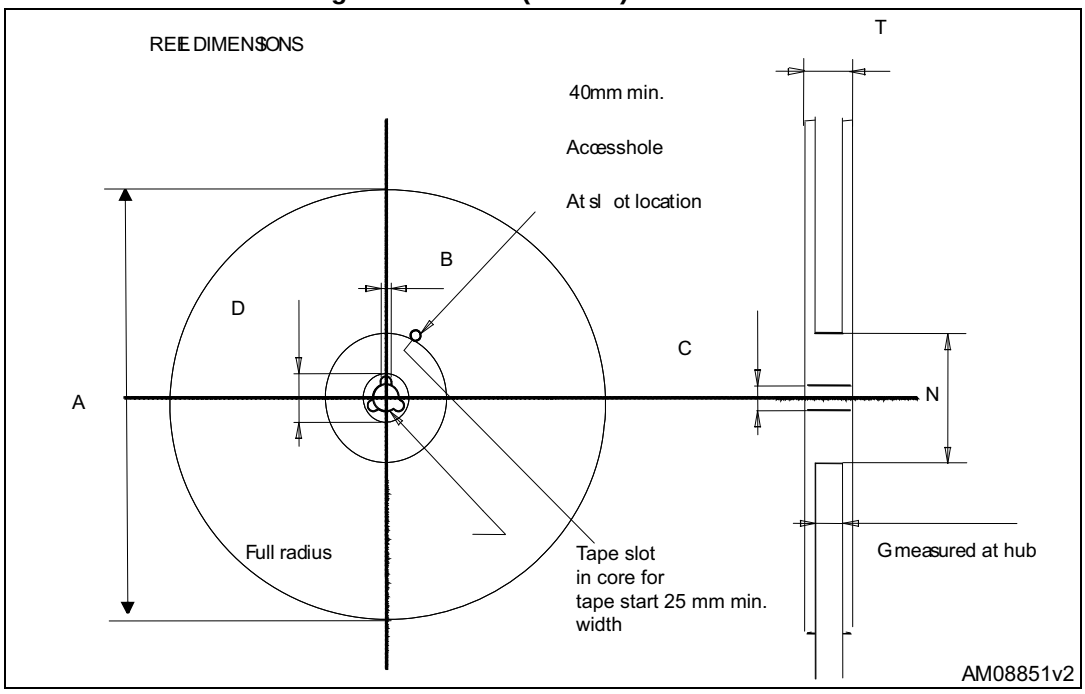


Table 13. DPAK (TO-252) tape and reel mechanical data

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

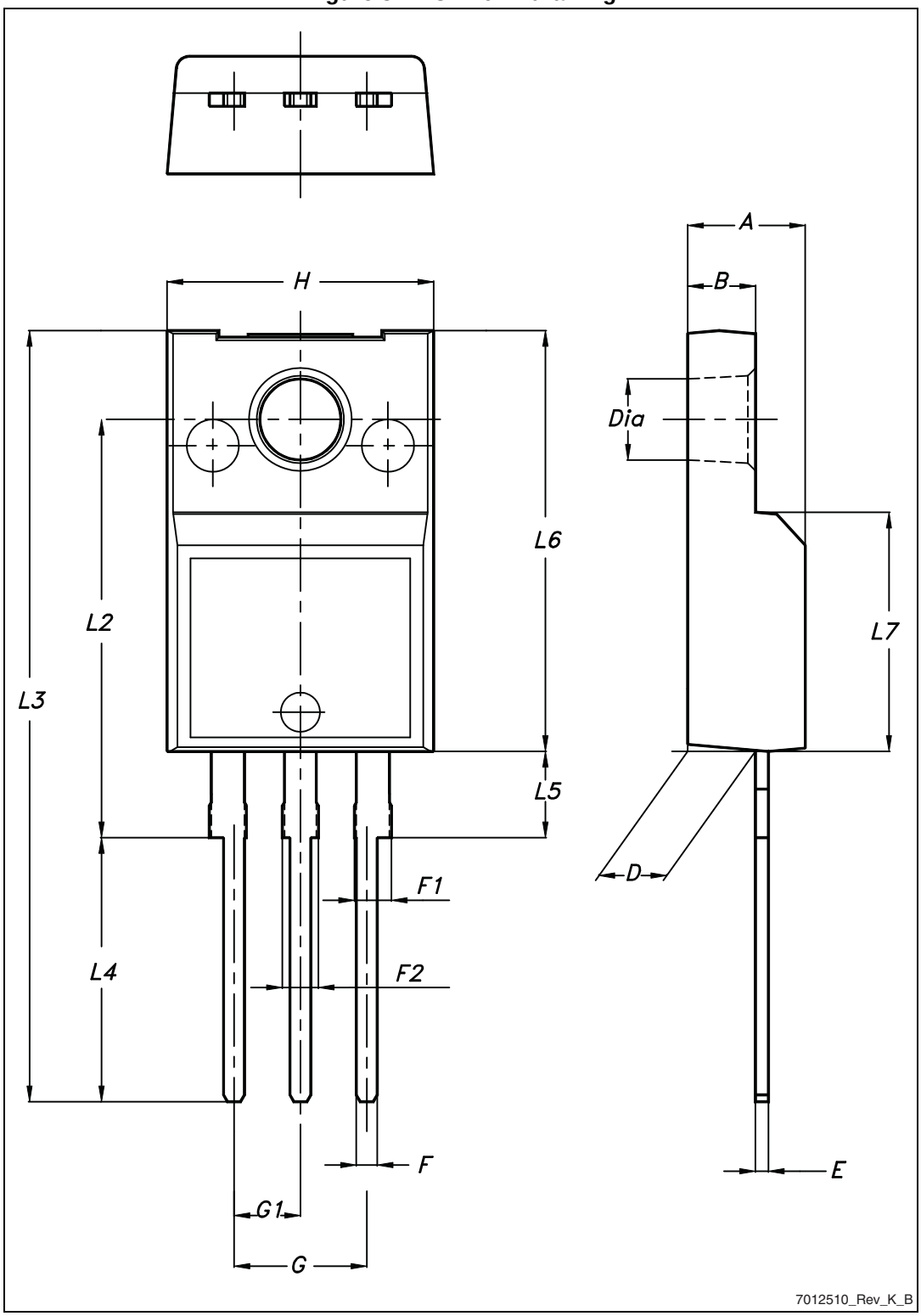


Table 14. TO-220FP mechanical data

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

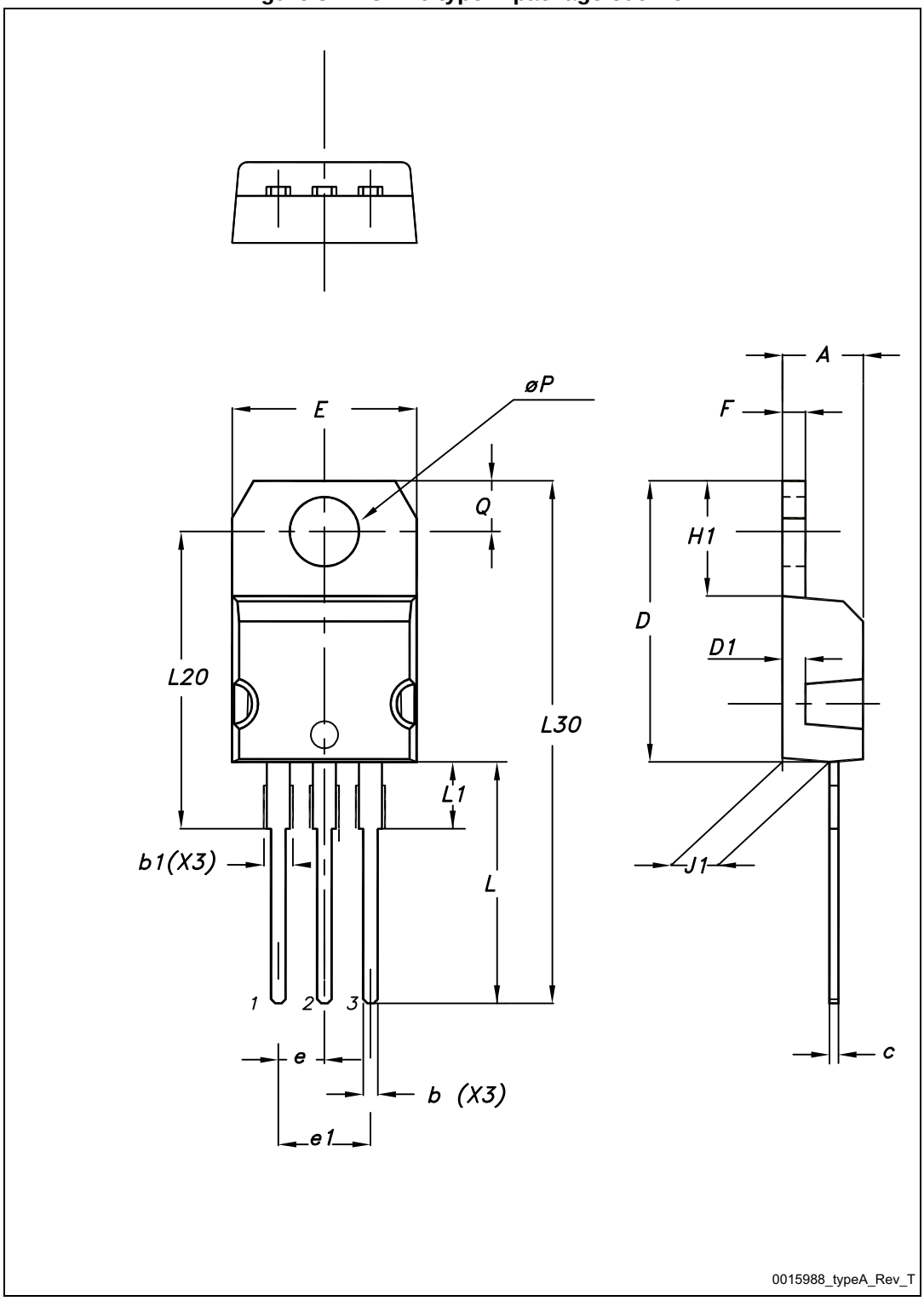


Table 15. TO-220 type A mechanical data

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)