

STD80N10F7, STF80N10F7, STH80N10F7-2, STP80N10F7

N-channel 100 V, 0.008 Ω typ., 80 A STripFET™ VII DeepGATE™ Power MOSFETs in DPAK, TO-220FP, H²PAK-2 and TO-220

Datasheet - production data

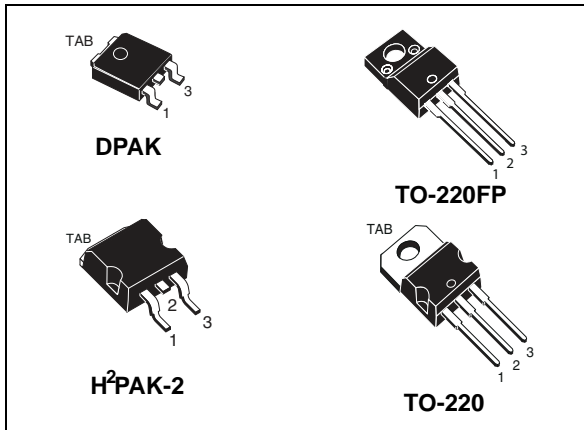
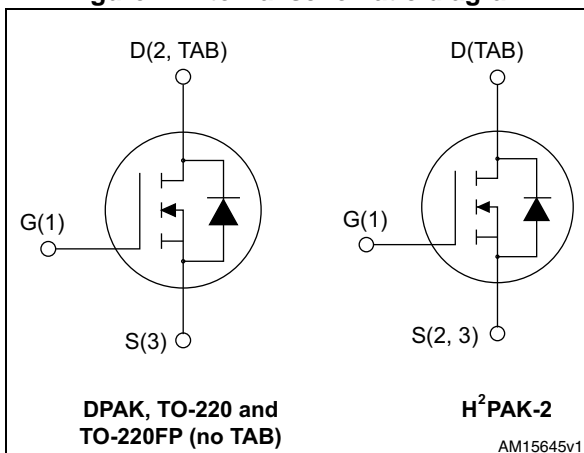


Figure 1. Internal schematic diagram



Features

Order codes	$V_{DS} @ T_{Jmax}$	$R_{DS(on) max}$	I_D	P_{TOT}
STD80N10F7	100 V	0.01 Ω	70 A	85 W
STF80N10F7		0.01 Ω	40 A	30 W
STH80N10F7-2		0.0095 Ω	80 A	110 W
STP80N10F7		0.01 Ω		

- Extremely low gate charge
- Ultra low on-resistance
- Low gate input resistance

Applications

- Switching applications

Description

These devices utilize the 7th generation of design rules of ST's proprietary STripFET™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest $R_{DS(on)}$ in all packages.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STD80N10F7	80N10F7	DPAK	Tape and reel
STF80N10F7		TO-220FP	Tube
STH80N10F7-2		H ² PAK-2	Tape and reel
STP80N10F7		TO-220	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value			Unit
		DPAK	H ² PAK-2 TO-220	TO-220FP	
V _{DS}	Drain-source voltage	100			V
V _{GS}	Gate-source voltage	± 20			V
I _D	Drain current (continuous) at T _C = 25 °C	70	80	40	A
I _D	Drain current (continuous) at T _C = 100 °C	48	54	30	A
I _{DM} ⁽¹⁾	Drain current (pulsed)	280	320	160	A
P _{TOT}	Total dissipation at T _C = 25 °C	85	110	30	W
T _{stg}	Storage temperature	- 55 to 175			°C
T _j	Max. operating junction temperature				

1. Pulse width limited by safe operating area.

Table 3. Thermal data

Symbol	Parameter	Value				Unit
		DPAK	TO-220FP	H ² PAK-2	TO-220	
R _{thj-pcb}	Thermal resistance junction-pcb max	50		35		°C/W
R _{thj-amb}	Thermal resistance junction-ambient max		62.5		62.5	°C/W
R _{thj-case}	Thermal resistance junction-case max	1.76	5	1.36		°C/W

2 Electrical characteristics

($T_C = 25\text{ °C}$ unless otherwise specified)

Table 4. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu A, V_{GS} = 0$	100			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 100\text{ V}$ $V_{DS} = 100\text{ V}, T_C = 125\text{ °C}$			1 100	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = 20\text{ V}$			100	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu A$	2.5	3.5	4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	for DPAK, TO-220 and TO-220FP: $I_D = 40\text{ A}, V_{GS} = 10\text{ V}$		0.0085	0.010	Ω
		for H ² PAK-2: $V_{GS} = 10\text{ V}, I_D = 40\text{ A}$		0.008	0.0095	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 50\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$	-	3100	-	pF
C_{oss}	Output capacitance		-	700	-	pF
C_{rss}	Reverse transfer capacitance		-	45	-	pF
Q_g	Total gate charge	$V_{DD} = 50\text{ V}, I_D = 80\text{ A},$ $V_{GS} = 10\text{ V}$ (see Figure 18)	-	45	-	nC
Q_{gs}	Gate-source charge		-	18	-	nC
Q_{gd}	Gate-drain charge		-	13	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_d(on)$	Turn-on delay time	$V_{DD} = 50\text{ V}, I_D = 40\text{ A},$ $R_G = 4.7\ \Omega, V_{GS} = 10\text{ V}$ (see Figure 19 and Figure 22)	-	19	-	ns
t_r	Rise time		-	32	-	ns
$t_d(off)$	Turn-off delay time		-	36	-	ns
t_f	Fall time		-	13	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		80	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		320	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 80 \text{ A}$, $V_{GS} = 0$	-		1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 80 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$	-	70		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 80 \text{ V}$, $T_j = 150 \text{ }^\circ\text{C}$ (see Figure 22)	-	125		nC
I_{RRM}	Reverse recovery current		-	3.6		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 DPAK, H²PAK-2 and TO-220

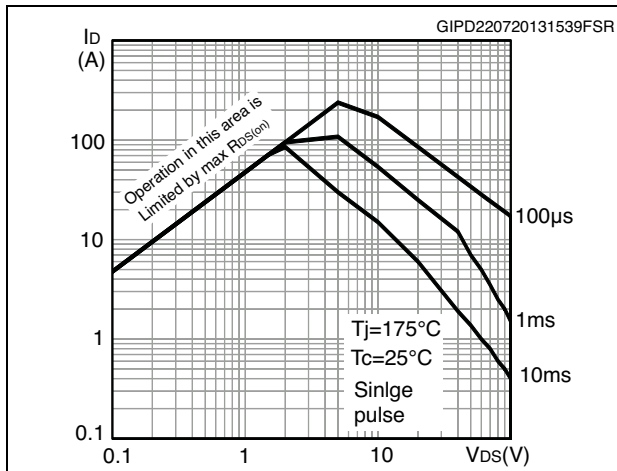


Figure 3. Thermal impedance for DPAK, H²PAK-2 and TO-220

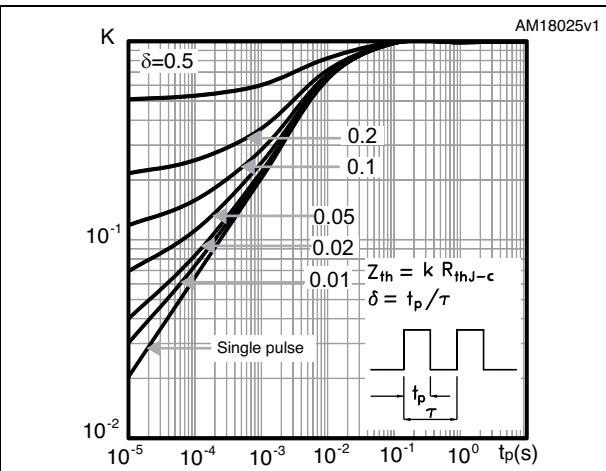


Figure 4. Safe operating area for TO-220FP

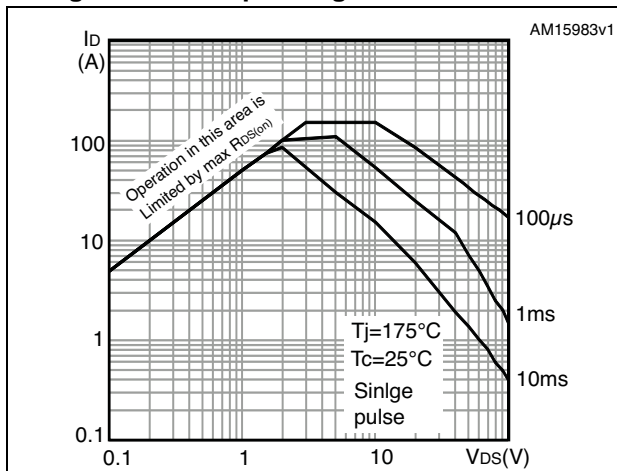


Figure 5. Thermal impedance for TO-220FP

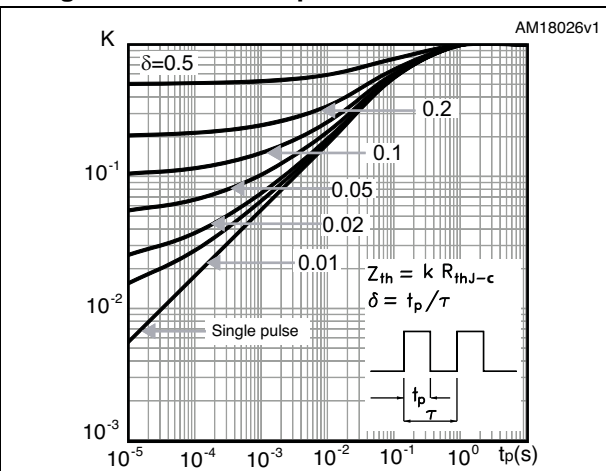


Figure 6. Output characteristics

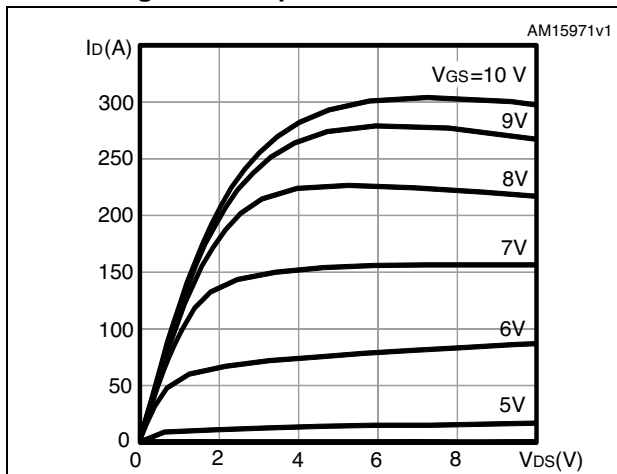


Figure 7. Transfer characteristics

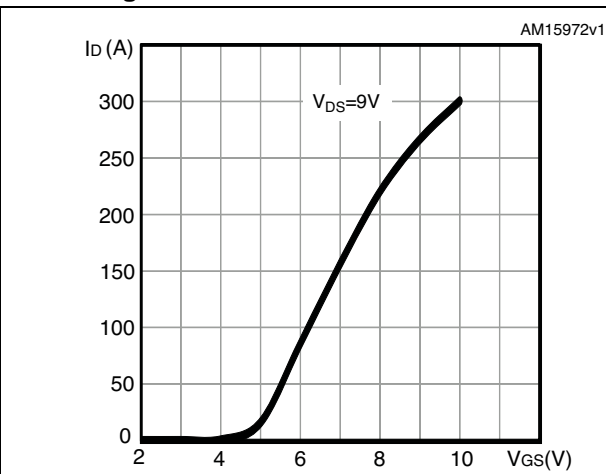


Figure 8. Static drain-source on-resistance for DPAK and TO-220

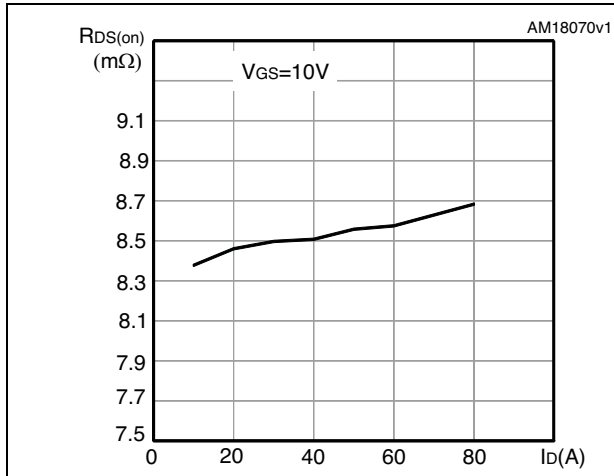


Figure 9. Static drain-source on-resistance for H²PAK-2

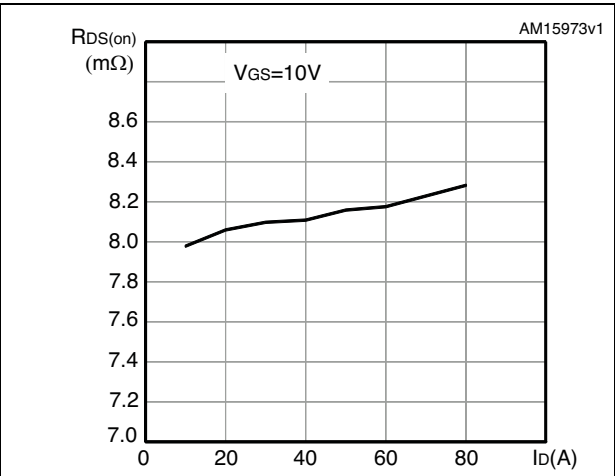


Figure 10. Static drain-source on-resistance for TO-220FP

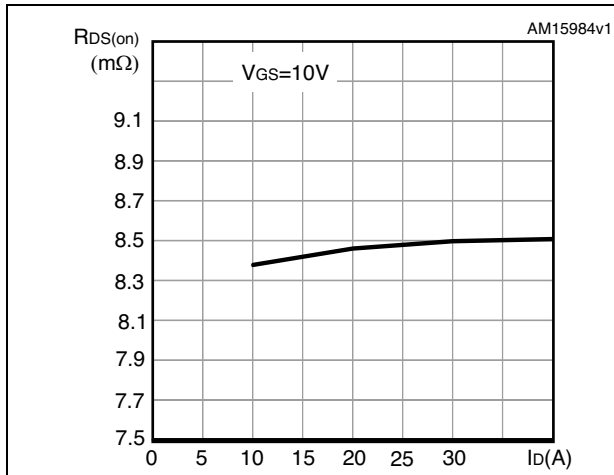


Figure 11. Gate charge vs gate-source voltage

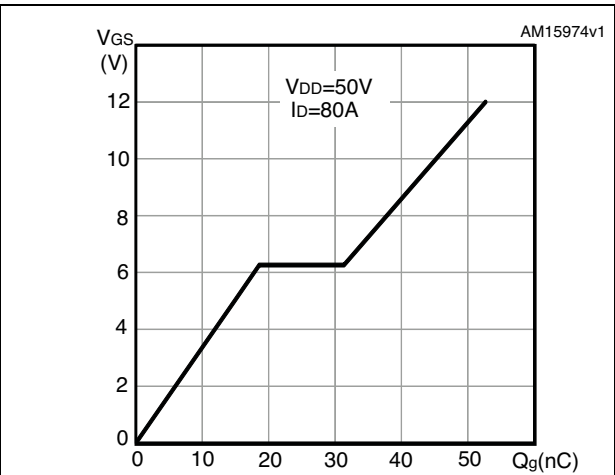


Figure 12. Capacitance variations

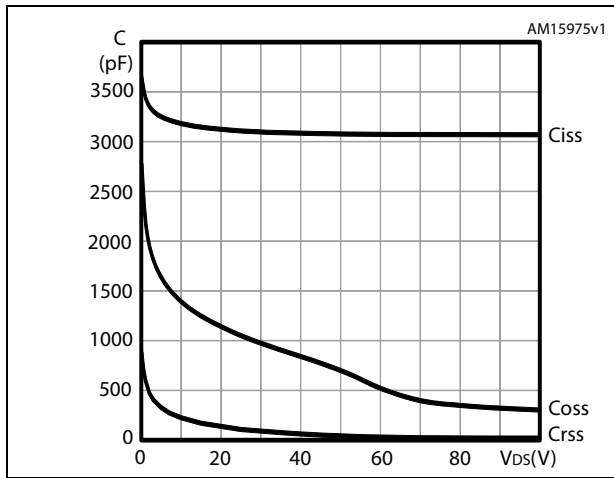


Figure 13. Normalized gate threshold voltage vs temperature

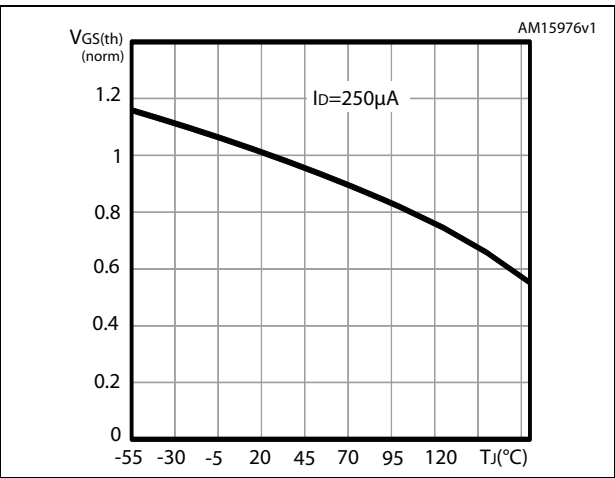


Figure 14. Normalized on-resistance vs temperature

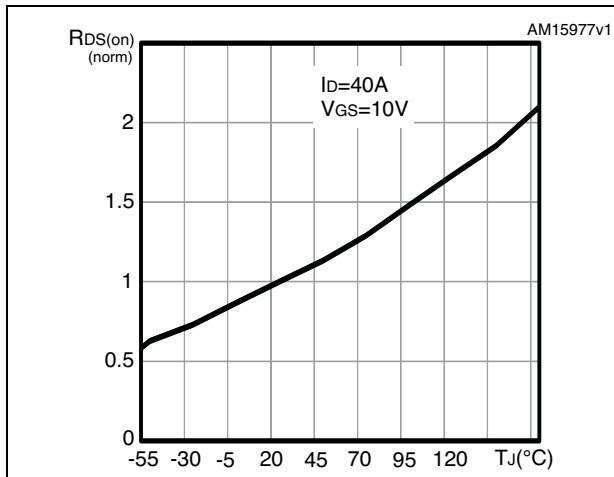


Figure 15. Source-drain diode forward characteristics

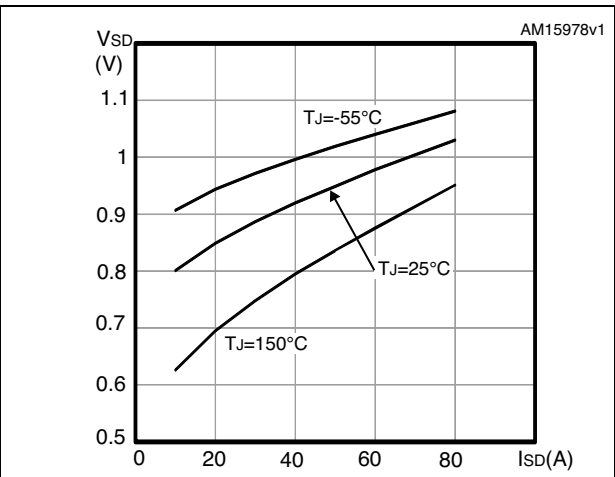
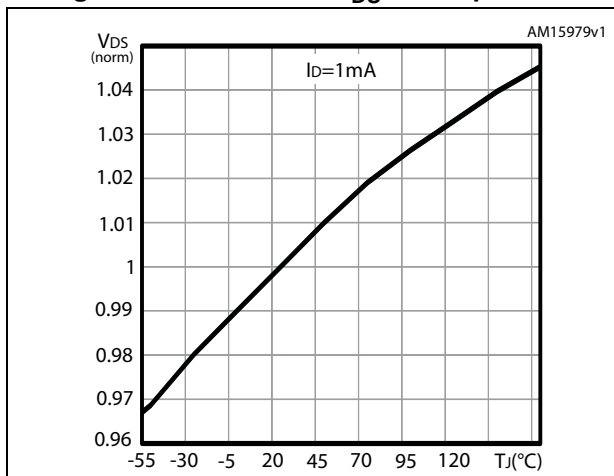
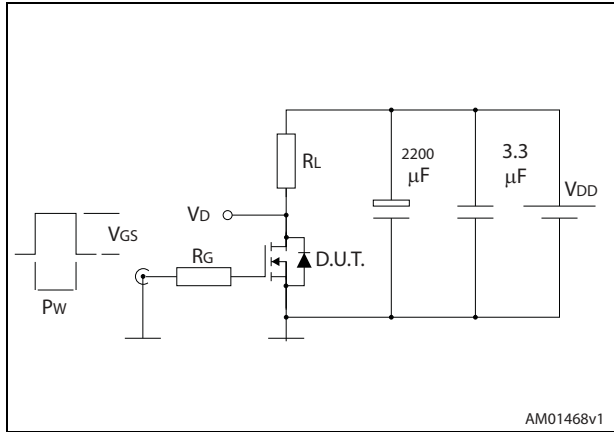


Figure 16. Normalized V_{DS} vs temperature



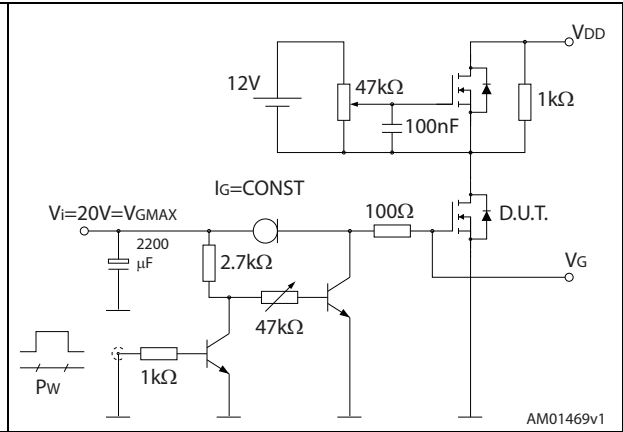
3 Test circuits

Figure 17. Switching times test circuit for resistive load



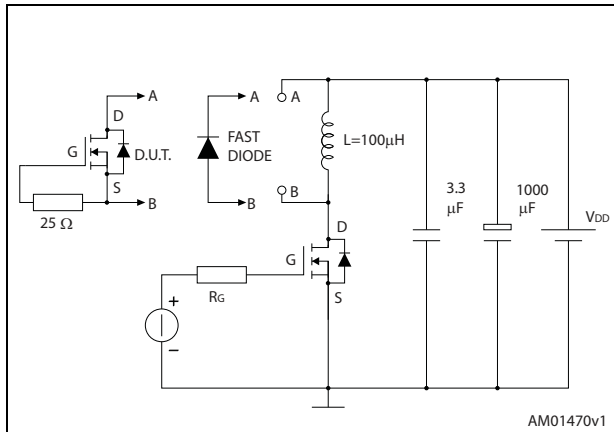
AM01468v1

Figure 18. Gate charge test circuit



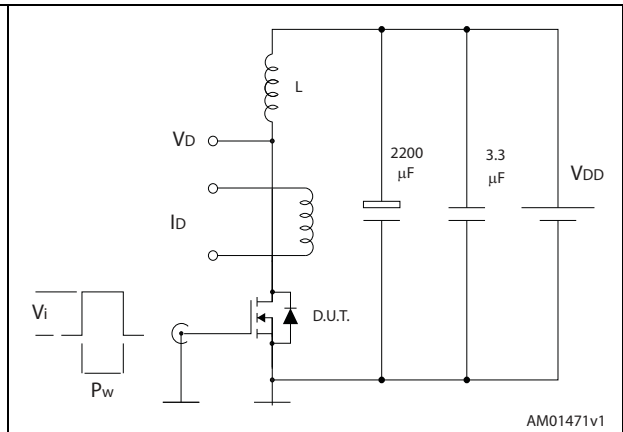
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Figure 19. Test circuit for inductive load switching and diode recovery times



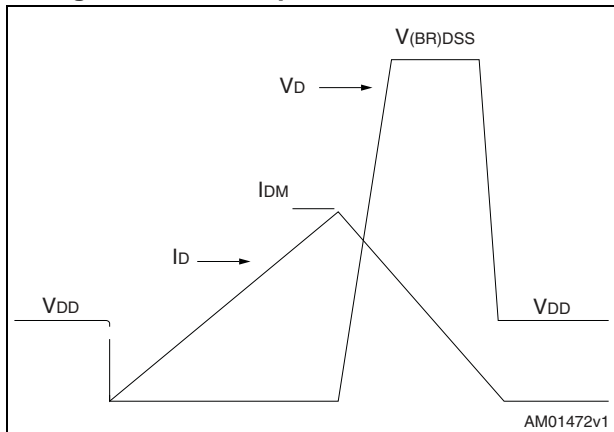
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Figure 20. Unclamped inductive load test circuit



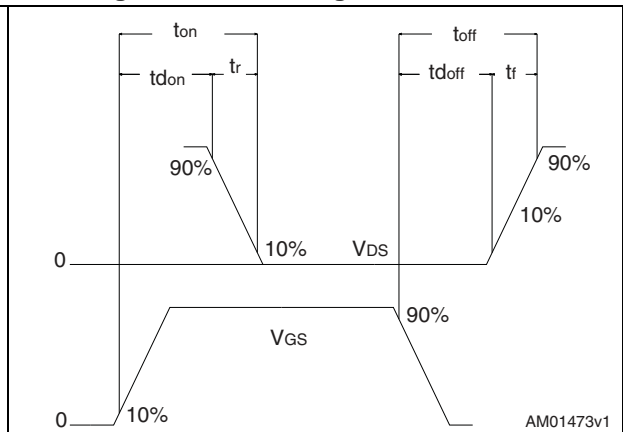
AM01471v1

Figure 21. Unclamped inductive waveform



AM01472v1

Figure 22. Switching time waveform



AM01473v1

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.

Figure 23. TO-220FP drawing

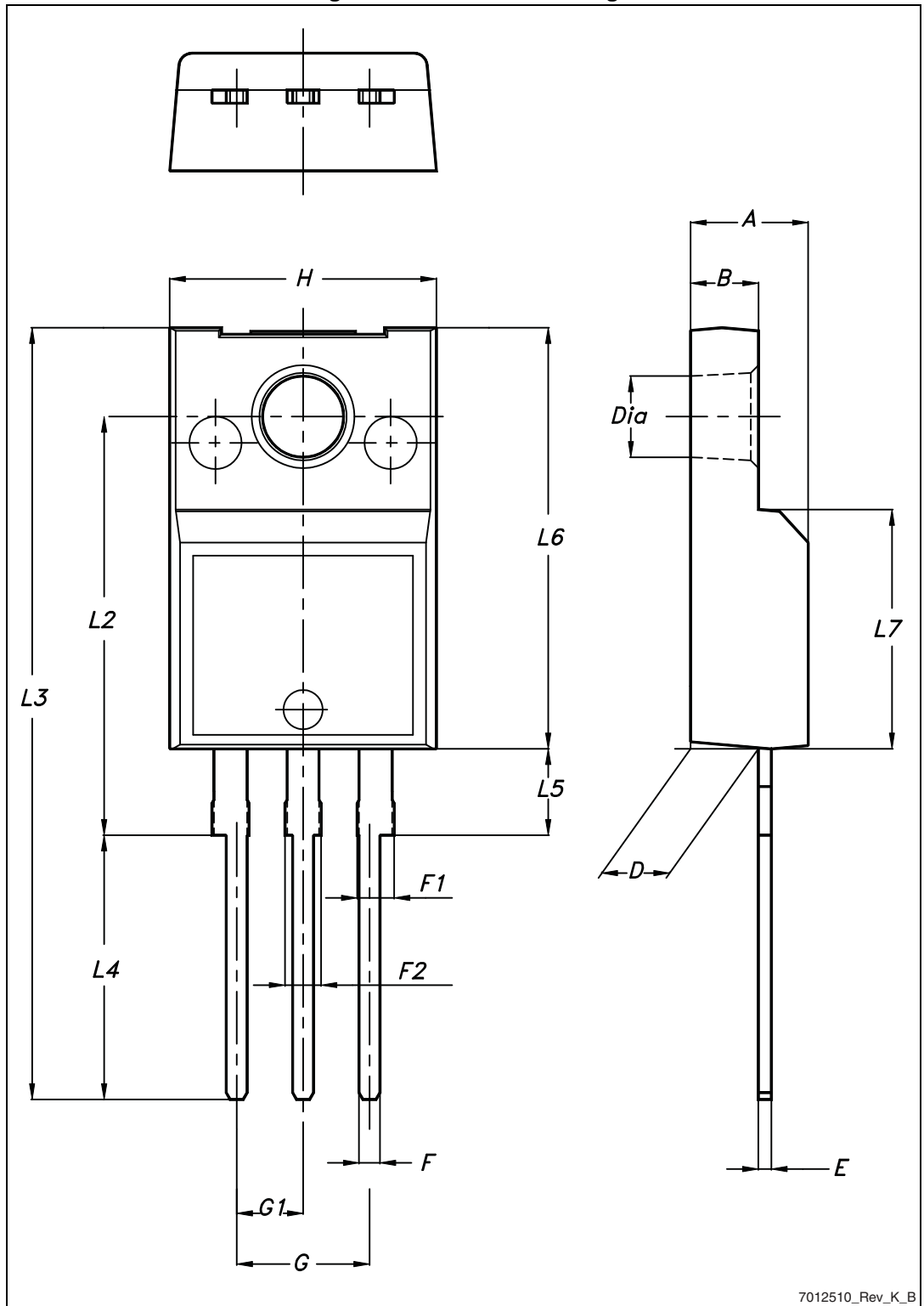


Table 8. TO-220FP mechanical data

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. DPAK (TO-252) type A drawing

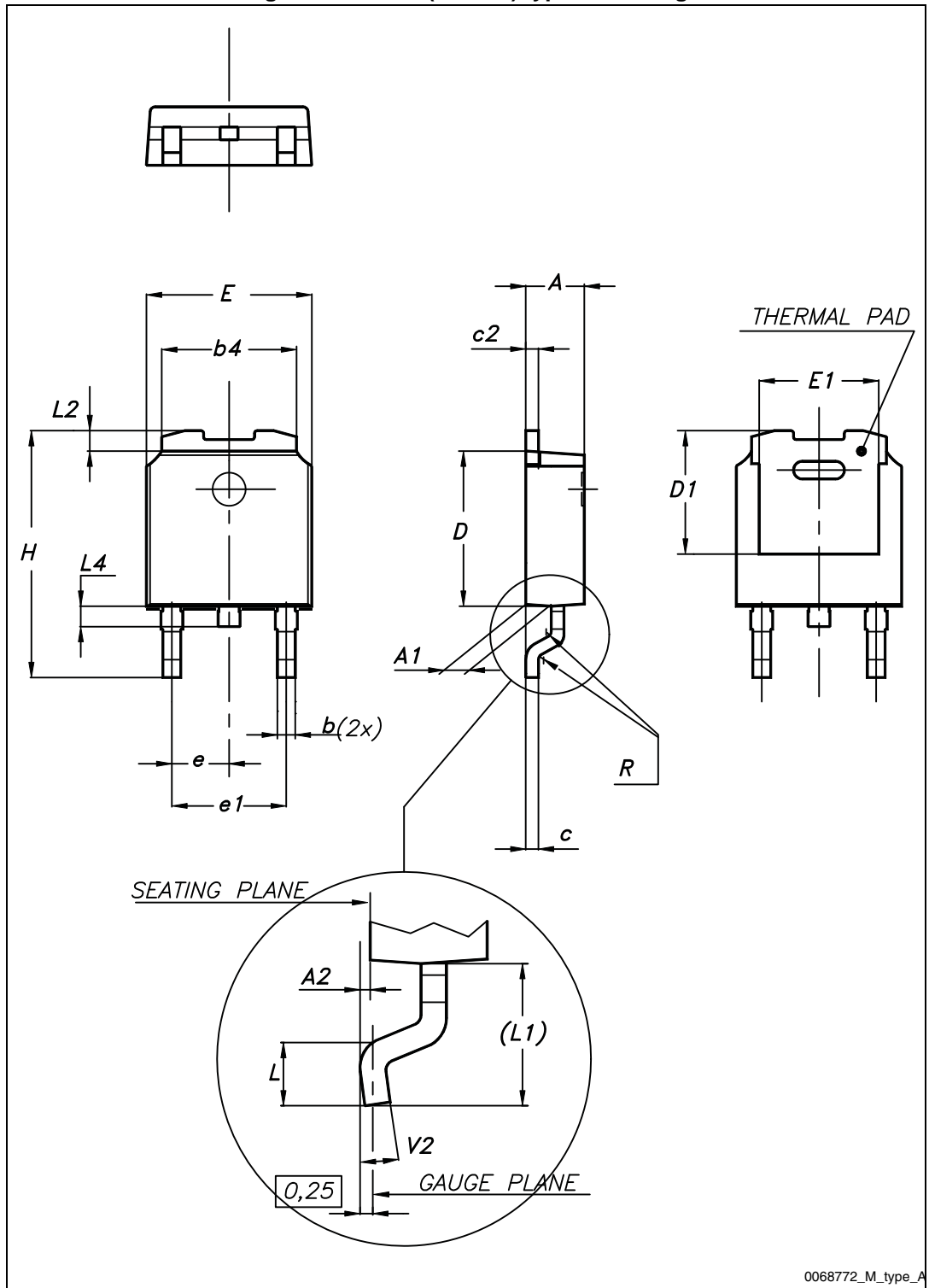
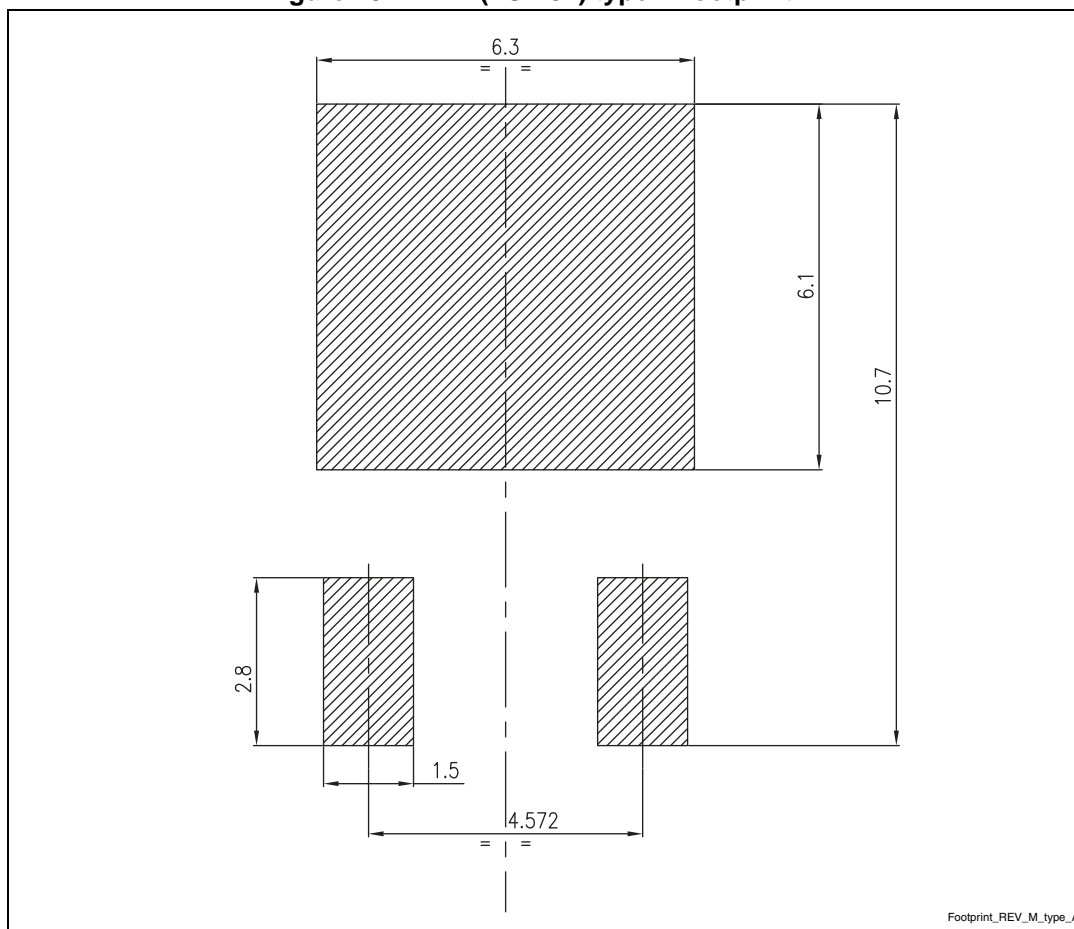


Table 9. DPAK (TO-252) type A mechanical data

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		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
(L1)		2.80	
L2		0.80	
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 25. DPAK (TO-252) type A footprint (a)



a. All dimensions are in millimeters

Figure 26. H²PAK-2 drawing

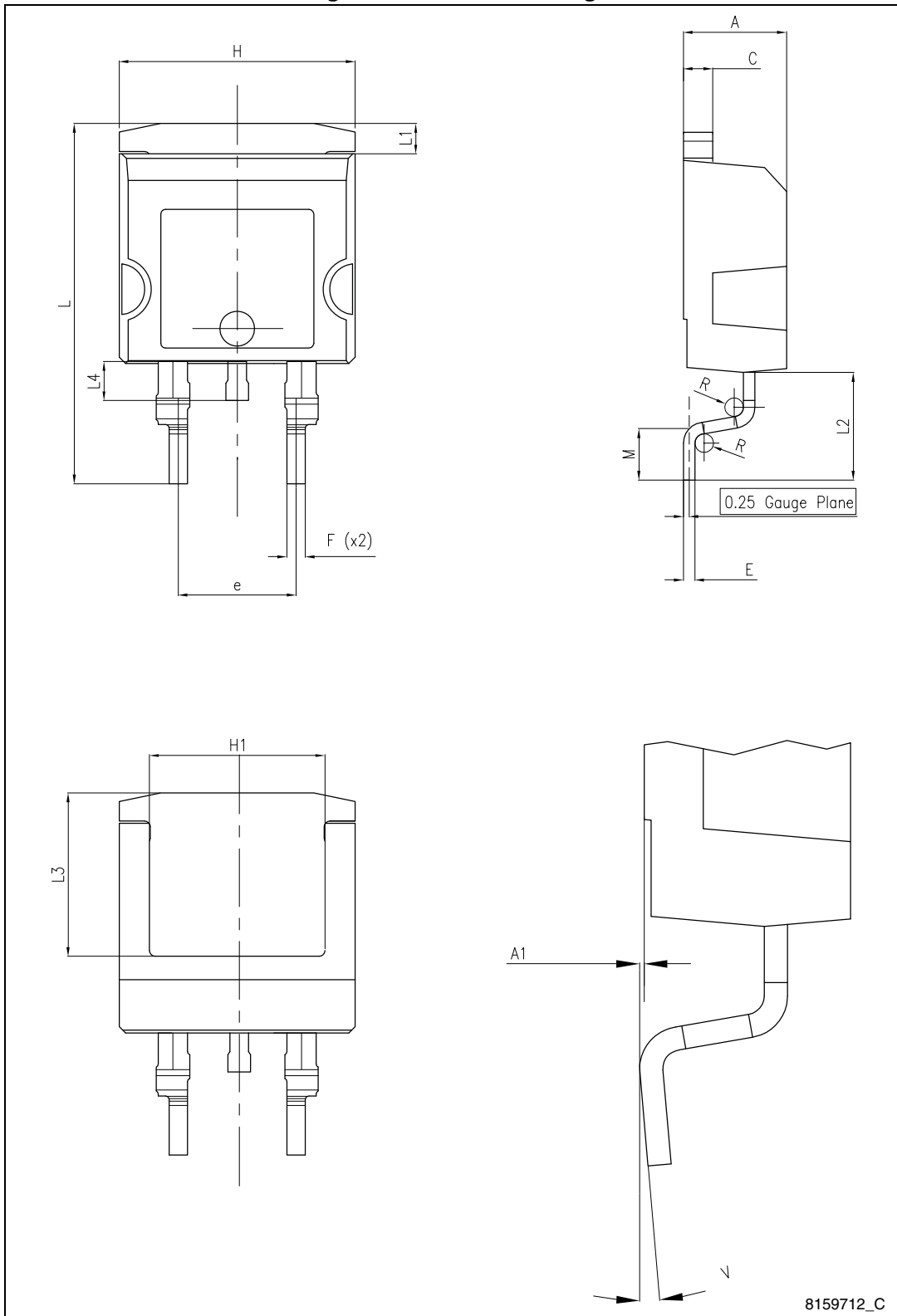


Table 10. H²PAK-2 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.80
A1	0.03		0.20
C	1.17		1.37
e	4.98		5.18
E	0.50		0.90
F	0.78		0.85
H	10.00		10.40
H1	7.40		7.80
L	15.30		15.80
L1	1.27		1.40
L2	4.93		5.23
L3	6.85		7.25
L4	1.5		1.7
M	2.6		2.9
R	0.20		0.60
V	0°		8°

Figure 27. H²PAK-2 recommended footprint (dimensions are in mm)

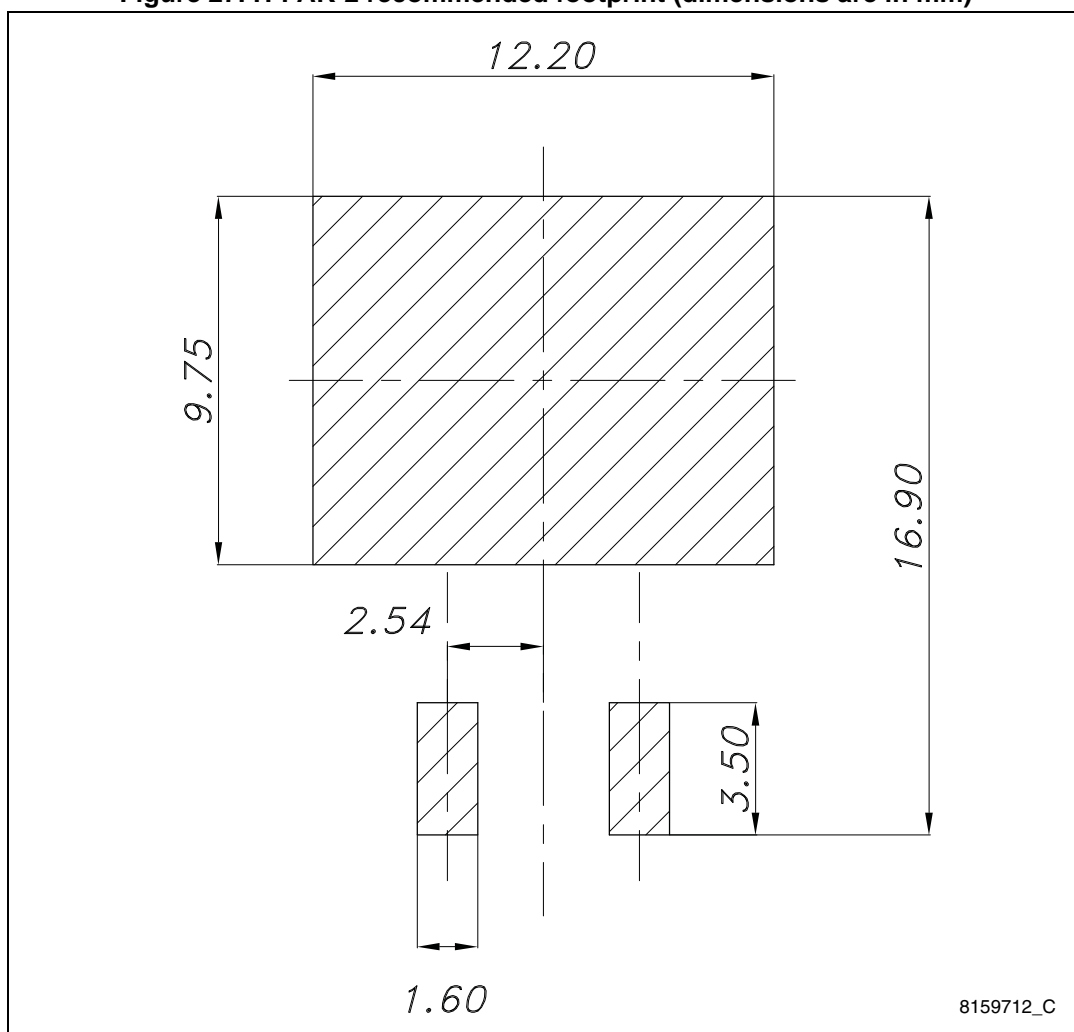


Figure 28. TO-220 type A drawing

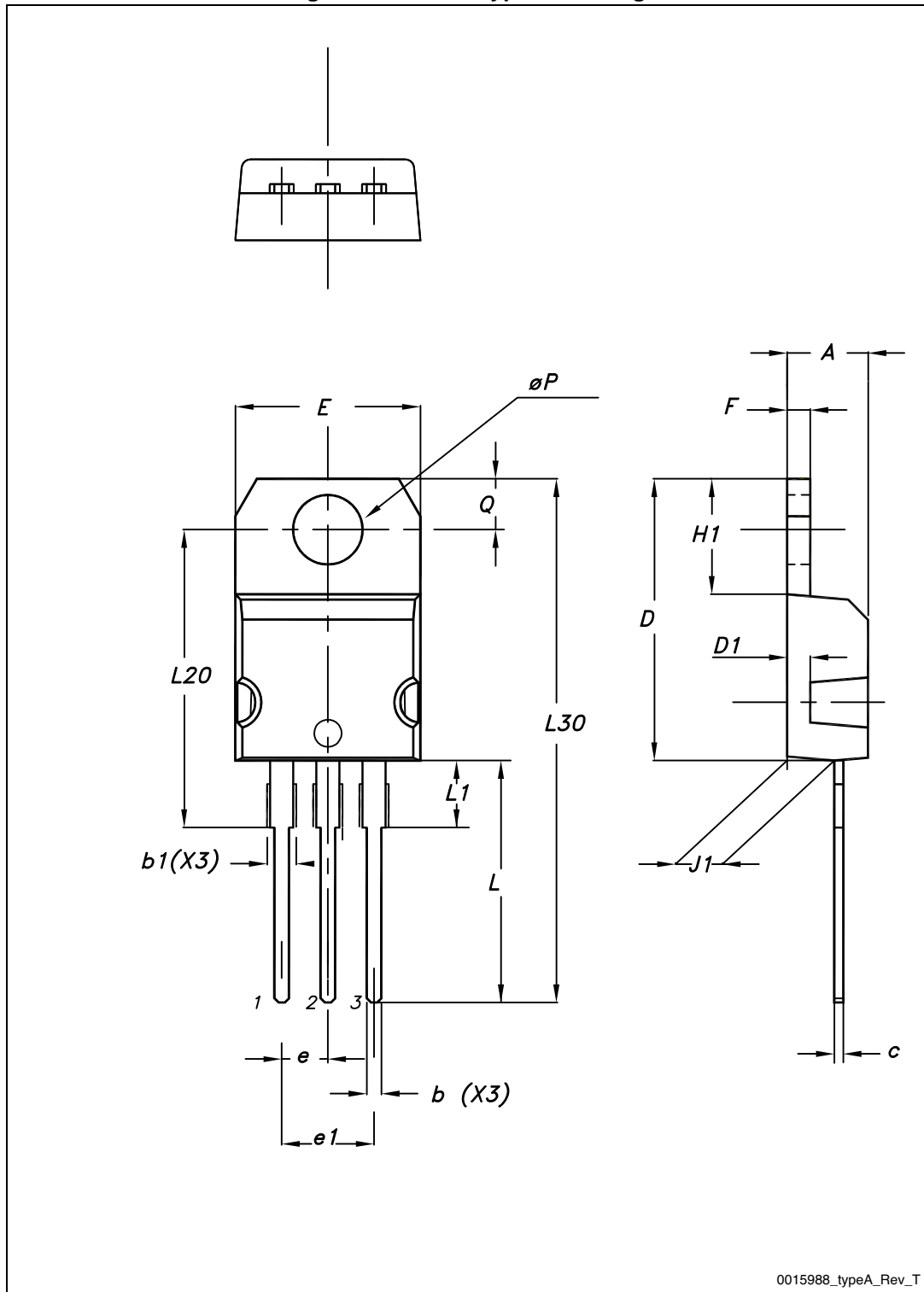


Table 11. TO-220 type A mechanical data

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	
ØP	3.75		3.85
Q	2.65		2.95

5 Packaging mechanical data

Figure 29. Tape for DPAK (TO-252)

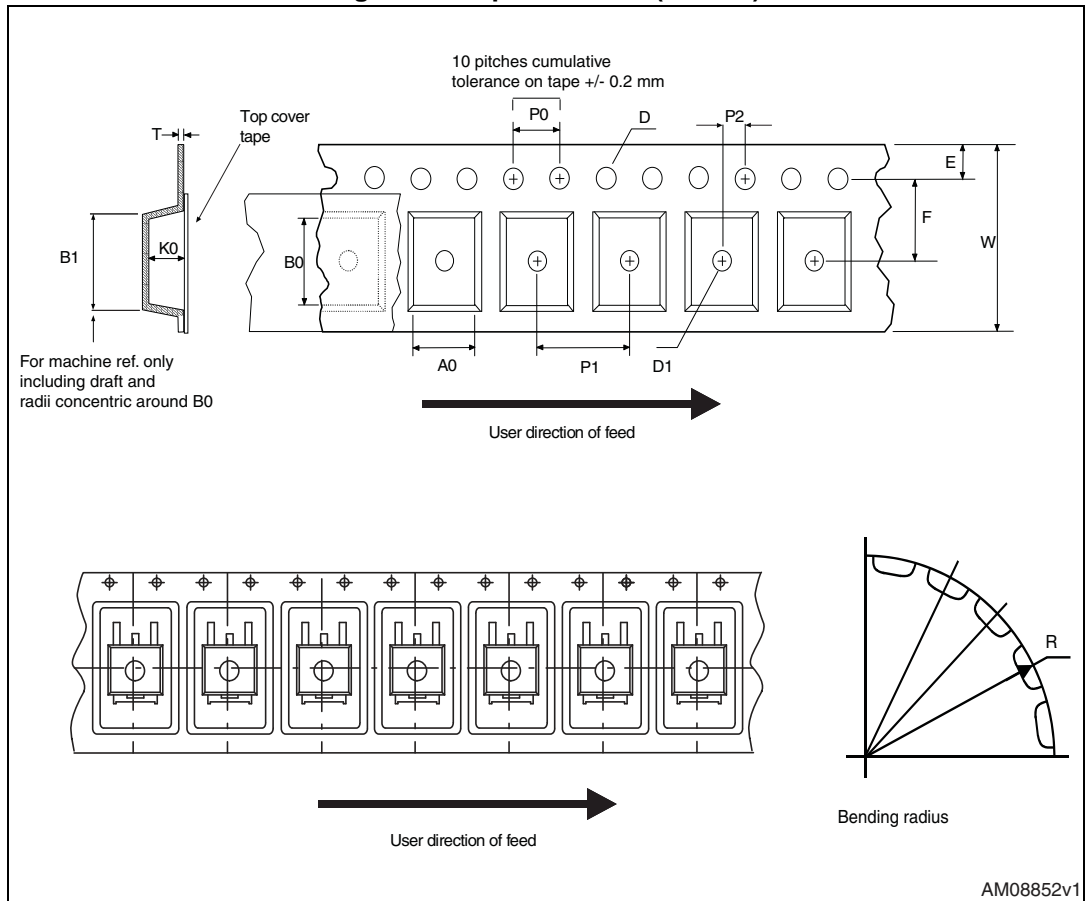


Figure 30. Reel for DPAK (TO-252)

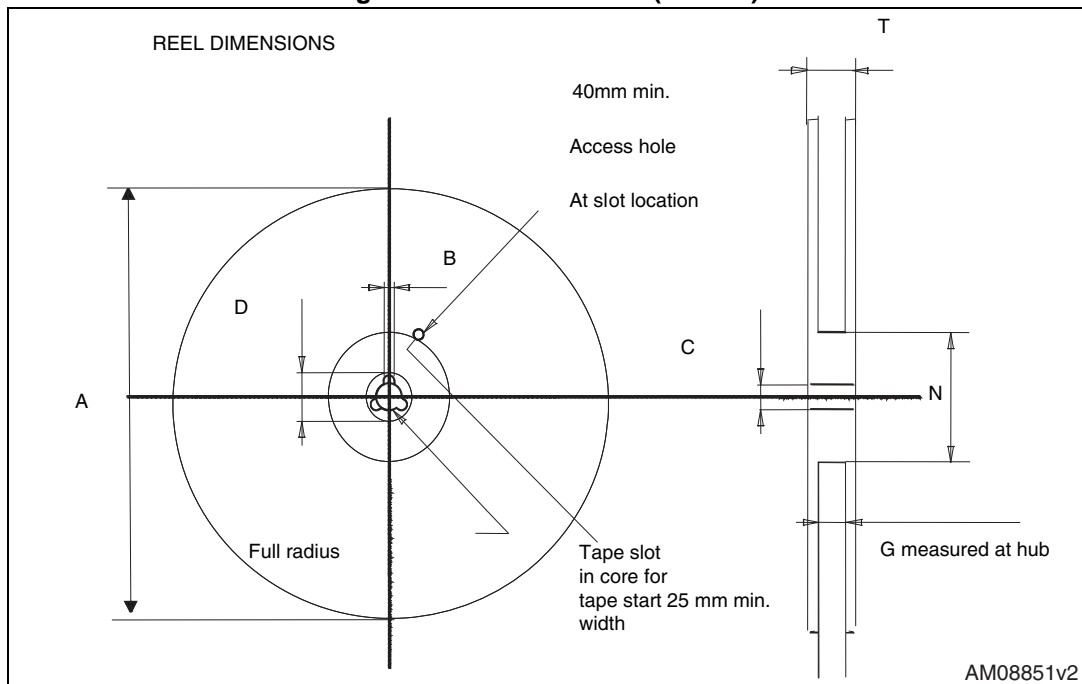


Table 12. DPAK (TO-252) tape and reel mechanical data

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			

Table 13. H²PAK-2 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			

6 Revision history

Table 14. Document revision history

Date	Revision	Changes
07-Feb-2014	1	First release.

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