



STF130N10F3, STFI130N10F3, STH130N10F3-2, STP130N10F3

N-channel 100 V, 7.8 mΩ typ., 120 A STripFET™III Power MOSFET
in TO-220FP, I²PAKFP, H²PAK-2 and TO-220 packages

Datasheet — production data

Features

Order codes	V _{DSS}	R _{DS(on)} max.	I _D
STF130N10F3	100 V	9.6 mΩ	46 A
STFI130N10F3			
STH130N10F3-2		9.3 mΩ	120 A
STP130N10F3		9.6 mΩ	

- Ultra low on-resistance
- 100% avalanche tested

Applications

- High current switching applications

Description

These devices are N-channel enhancement mode Power MOSFETs produced using STMicroelectronics' STripFET™ III technology, which is specifically designed to minimize on-resistance and gate charge to provide superior switching performance.

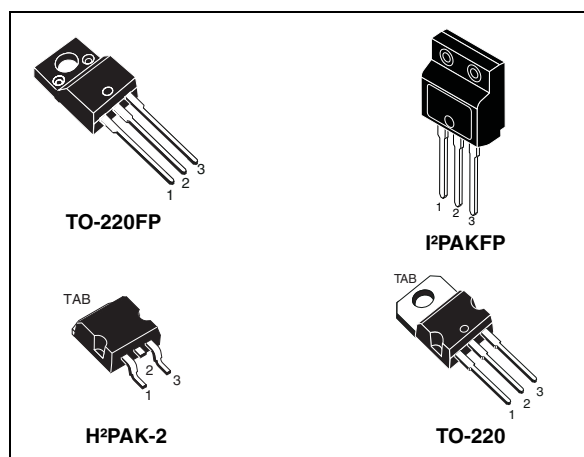


Figure 1. Internal schematic diagram

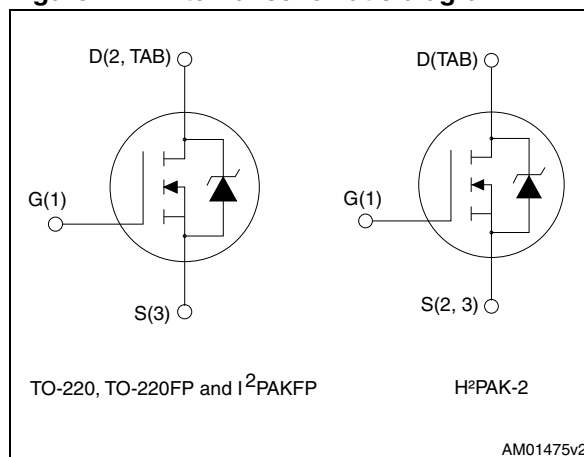


Table 1. Device summary

Order codes	Marking	Package	Packaging
STF130N10F3	130N10F3	TO-220FP	Tube
STFI130N10F3		I ² PAKFP	Tube
STH130N10F3-2		H ² PAK-2	Tape and reel
STP130N10F3		TO-220	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value			Unit
		TO-220FP I ² PAKFP	H ² PAK-2	TO-220	
V_{DS}	Drain-source voltage	100			V
V_{GS}	Gate-source voltage	± 20			V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	46	120		A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	29	78		A
$I_{DM}^{(2)}$	Drain current (pulsed)	184	450		A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	35	250		W
dv/dt	Peak diode recovery voltage slope	22			V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink ($t = 1$ s; $T_C = 25^\circ\text{C}$)	2500			V
$E_{AS}^{(3)}$	Single pulse avalanche energy	125			mJ
T_j T_{stg}	Operating junction temperature storage temperature	- 55 to 175			$^\circ\text{C}$

1. Current limited by package.
2. Pulse width limited by safe operating area.
3. Starting $T_j = 25^\circ\text{C}$, $I_D = 50$ A, $V_{DD} = 50$ V for TO-220 and H²PAK-2; Starting $T_j = 25^\circ\text{C}$, $I_D = 29$ A, $V_{DD} = 60$ V for I²PAKFP and TO-220FP.

Table 3. Thermal data

Symbol	Parameter	Value			Unit
		TO-220FP I ² PAKFP	H ² PAK-2	TO-220	
Rthj-case	Thermal resistance junction-case	4.3	0.6	0.6	$^\circ\text{C/W}$
Rthj-a	Thermal resistance junction-ambient	62.5		62.5	$^\circ\text{C/W}$
Rthj-pcb ⁽¹⁾	Thermal resistance junction-pcb		35		$^\circ\text{C/W}$

1. When mounted on FR-4 board, on 1inch², 2oz Cu.

2 Electrical characteristics

($T_{CASE} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 250\text{ }\mu\text{A}$	100	-		V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 100\text{ V}$ $T_C = 25^{\circ}\text{C}$ $T_C = 125^{\circ}\text{C}$		-	10 100	μA μA
I_{GSS}	Gate body leakage current	$V_{DS} = 0, V_{GS} = \pm 20\text{ V}$		-	± 200	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2	-	4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 23\text{ A}$ TO-220FP and I ² PAKFP		8	9.6	m Ω
		$V_{GS} = 10\text{ V}, I_D = 60\text{ A}$ H ² PAK TO-220		7.8 8	9.3 9.6	

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{GS} = 0, V_{DS} = 25\text{ V},$ $f = 1\text{ MHz}$	-	3305	-	pF
C_{oss}	Output capacitance			373		pF
C_{rss}	Reverse transfer capacitance			23		pF
Q_g	Total gate charge	$V_{DD} = 50\text{ V}, I_D = 120\text{ A},$	-	57	-	nC
Q_{gs}	Gate-source charge	$V_{GS} = 10\text{ V}$		22		nC
Q_{gd}	Gate-drain charge	(see Figure 20)		17		nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 50\text{ V}, I_D = 60\text{ A}$	-	17	-	ns
t_r	Rise time	$R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$		38		ns
$t_{d(off)}$	Turn-off delay time	(see Figure 19 ,		52		ns
t_f	Fall time	Figure 24)		7.2		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}^{(1)}$	Source-drain current Source-drain current (pulsed)	For TO-220FP and I ² PAKFP	-		46 184	A A
I_{SD} $I_{SDM}^{(2)}$	Source-drain current Source-drain current (pulsed)	For TO-220, H ² PAK-2	-		120 450	A A
$V_{SD}^{(3)}$	Forward on voltage	$I_{SD}=120\text{ A}$, $V_{GS}=0$; for TO-220, H ² PAK-2	-		1.5	V
		$I_{SD}=46\text{ A}$, $V_{GS}=0$; for TO-220FP and I ² PAKFP				
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD}=120\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD}=80\text{ V}$, $T_j=150\text{ }^{\circ}\text{C}$ (see Figure 21)	-	68 182 5.4		ns nC A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220FP and I²PAKFP

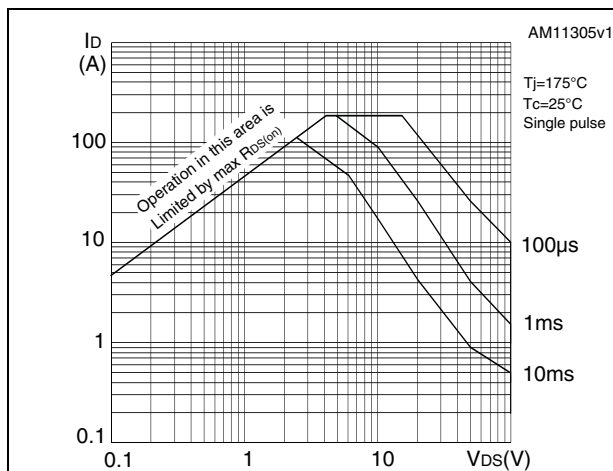


Figure 3. Thermal impedance for TO-220FP and I²PAKFP

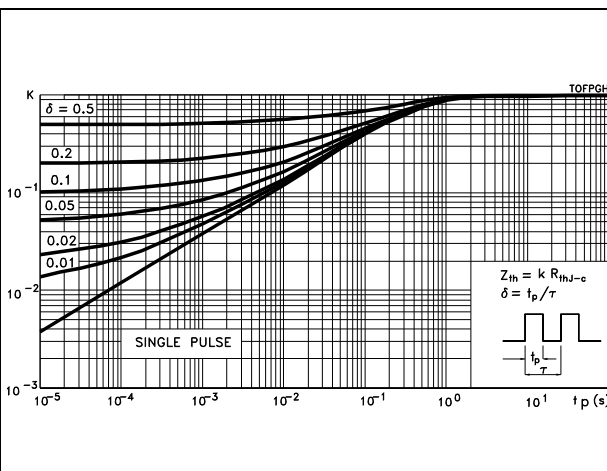


Figure 4. Safe operating area for H²PAK-2 and TO-220

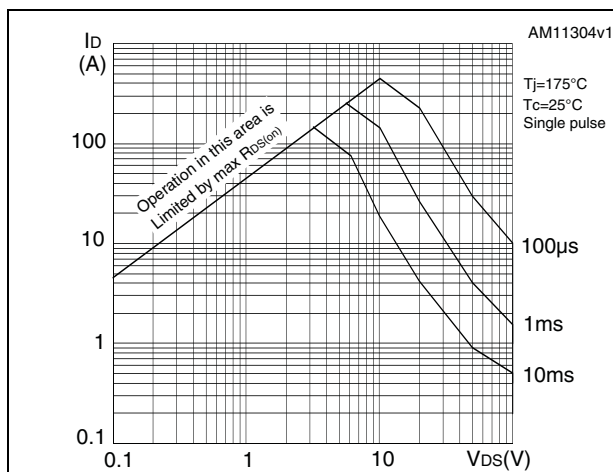


Figure 5. Thermal impedance for H²PAK-2 and TO-220

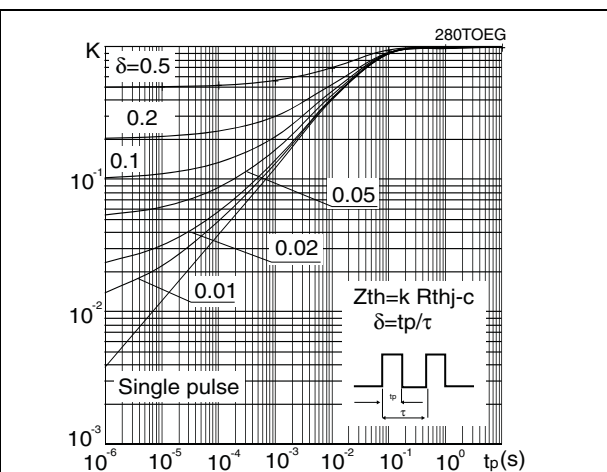


Figure 6. Output characteristics

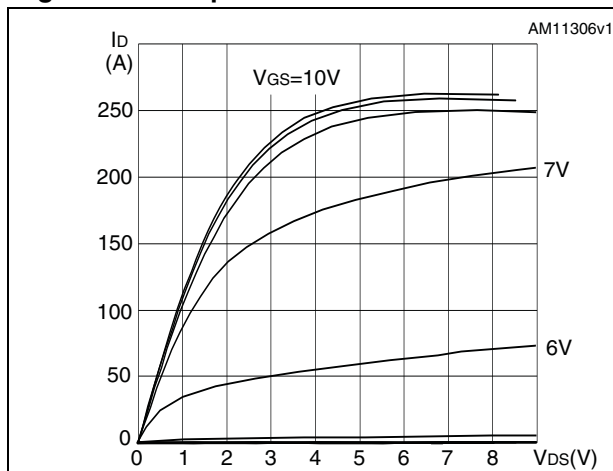


Figure 7. Transfer characteristics

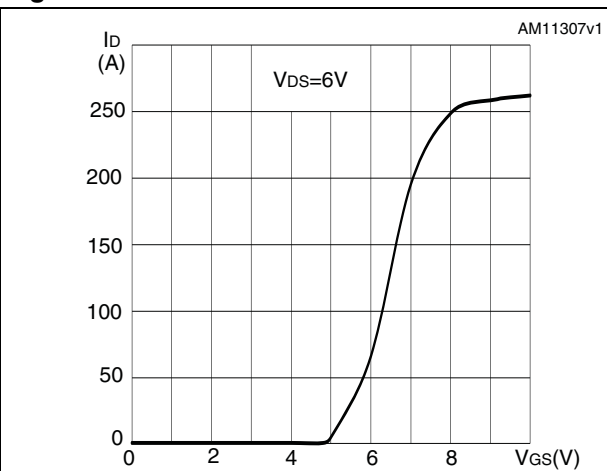


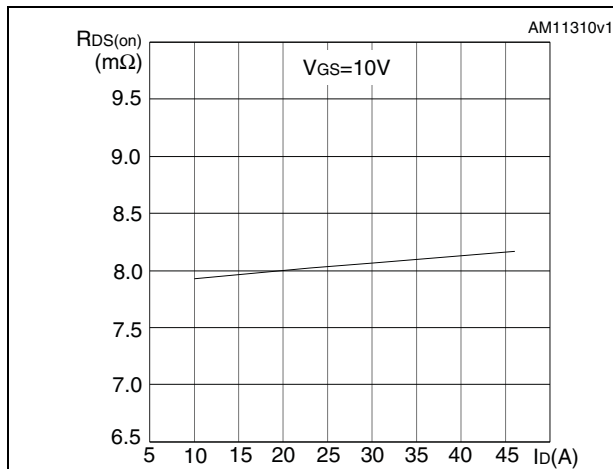
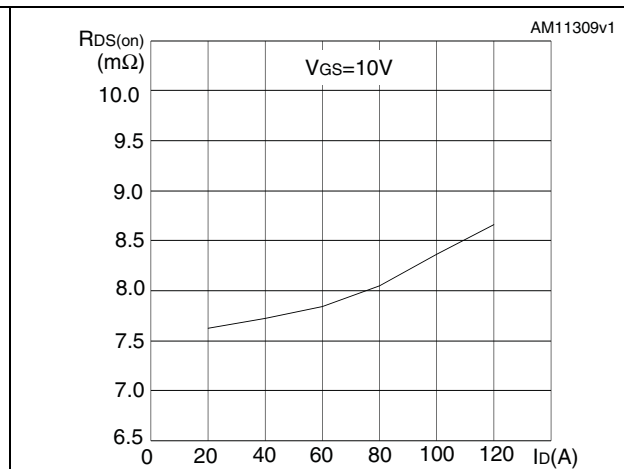
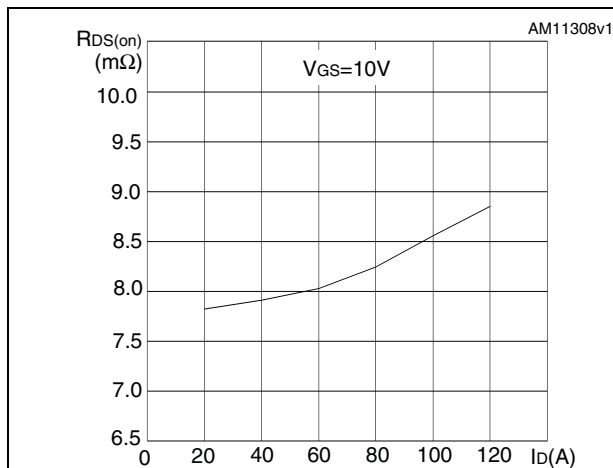
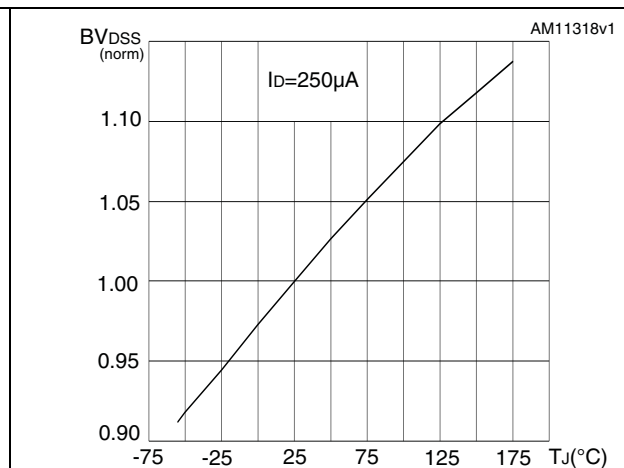
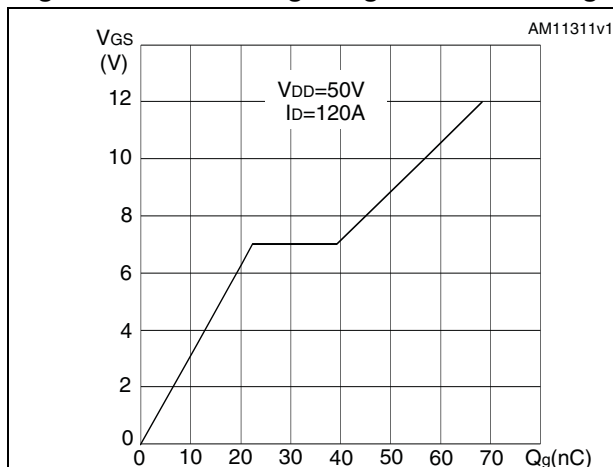
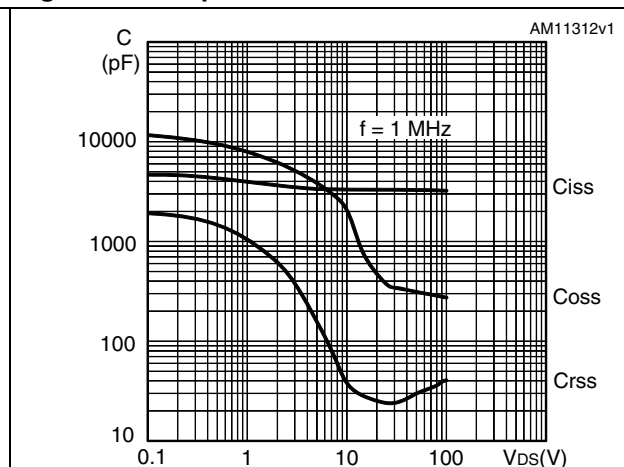
Figure 8. Static drain-source on-resistance for TO-220FP and I²PAKFP**Figure 9. Static drain-source on-resistance for H²PAK-2****Figure 10. Static drain-source on-resistance for TO-220****Figure 11. Normalized B_{VDSS} vs temperature****Figure 12. Gate charge vs gate-source voltage****Figure 13. Capacitance variations**

Figure 14. Normalized gate threshold voltage vs temperature

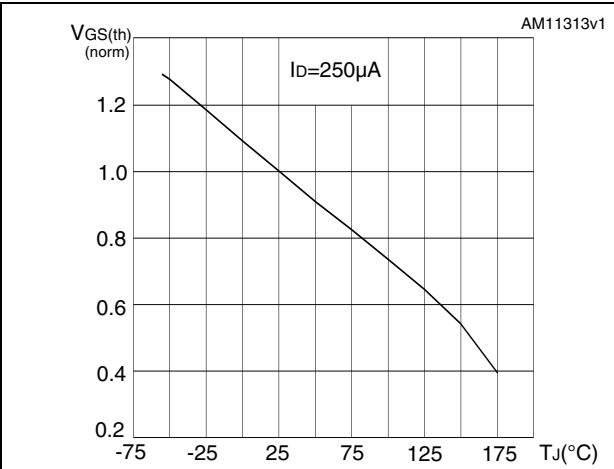


Figure 15. Normalized on-resistance vs temperature for TO-220FP and I²PAKFP

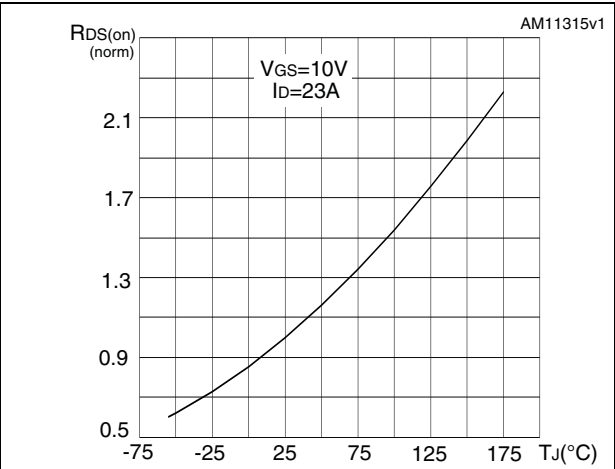


Figure 16. Normalized on resistance vs temperature for H²PAK-2 and TO-220

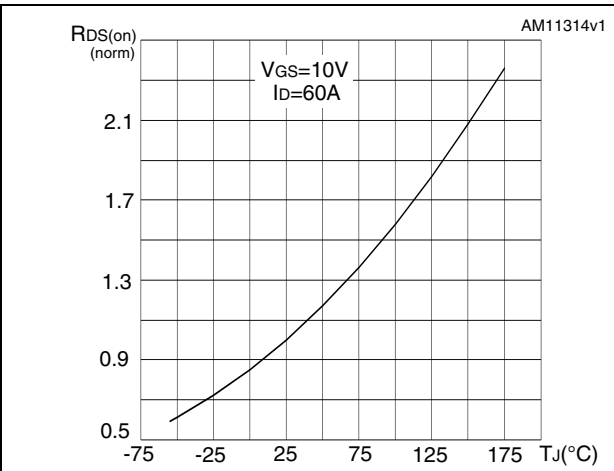


Figure 17. Source-drain diode forward characteristics for TO-220FP and I²PAKFP

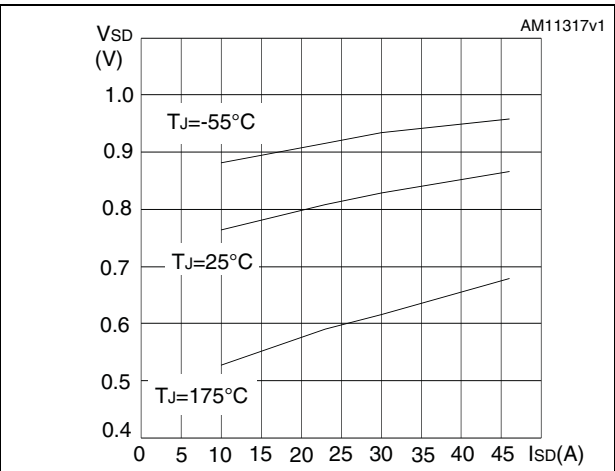
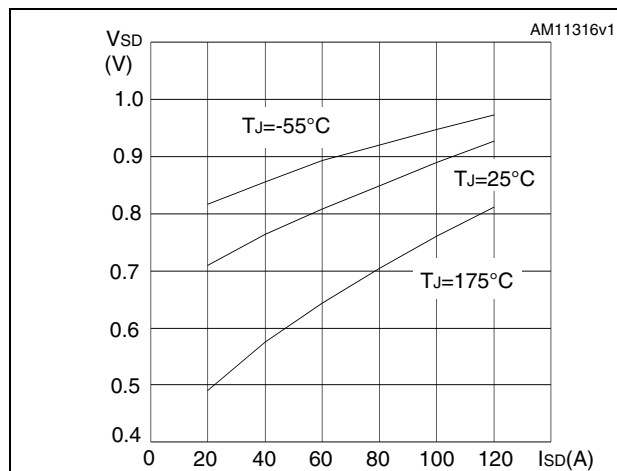
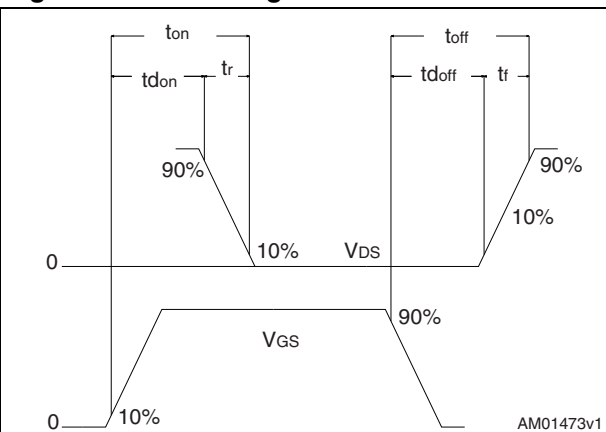
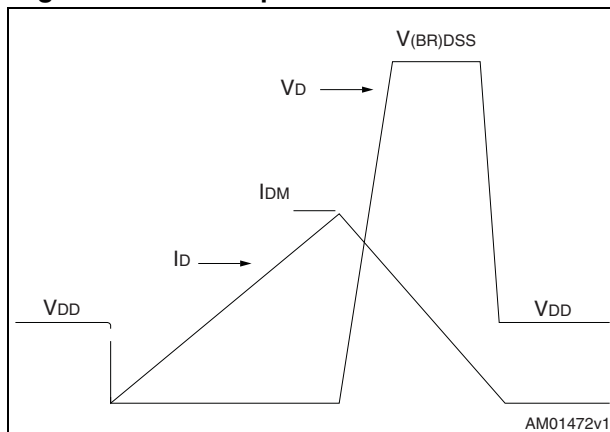
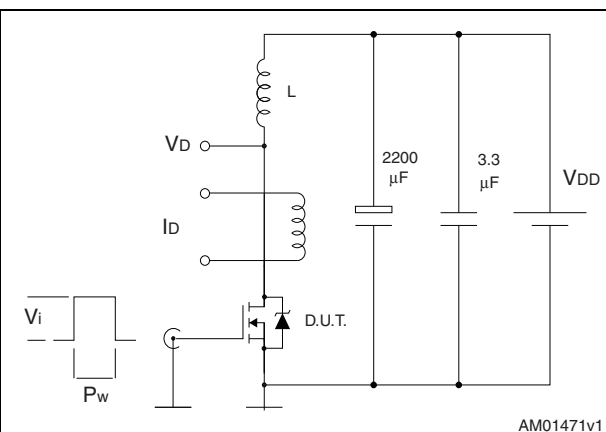
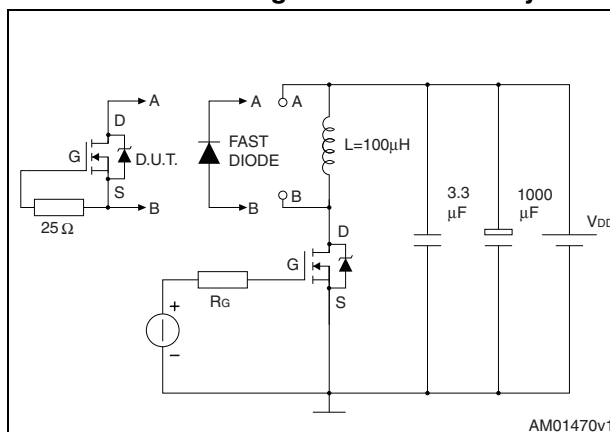
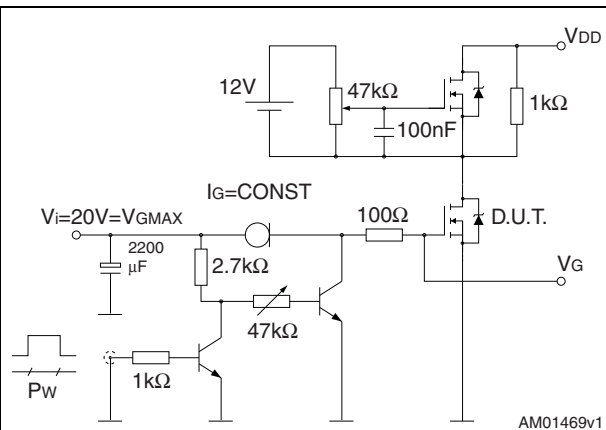
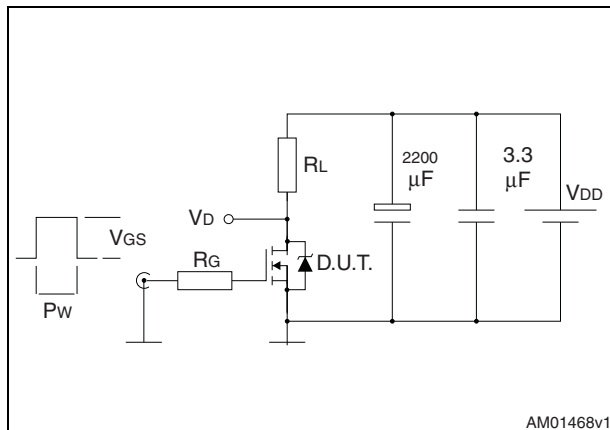


Figure 18. Source-drain diode forward characteristics for H²PAK-2 and TO-220





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 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 25. TO-220FP drawing

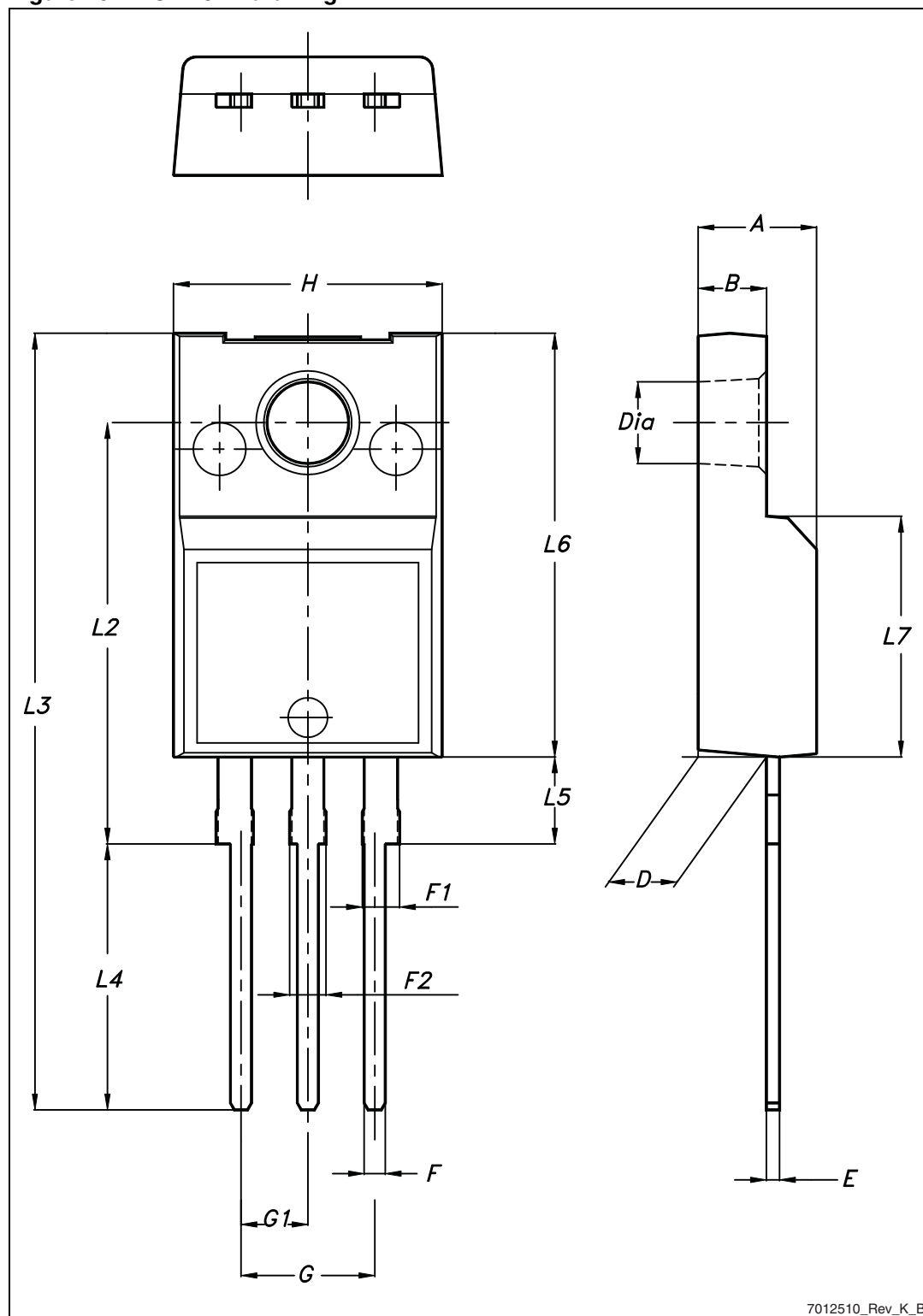


Table 9. I²PAKFP (TO-281) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40	-	4.60
B	2.50		2.70
D	2.50		2.75
D1	0.65		0.85
E	0.45		0.70
F	0.75		1.00
F1			1.20
G	4.95		5.20
H	10.00		10.40
L1	21.00		23.00
L2	13.20		14.10
L3	10.55		10.85
L4	2.70		3.20
L5	0.85		1.25
L6	7.30		7.50

Figure 26. I²PAKFP (TO-281) drawing

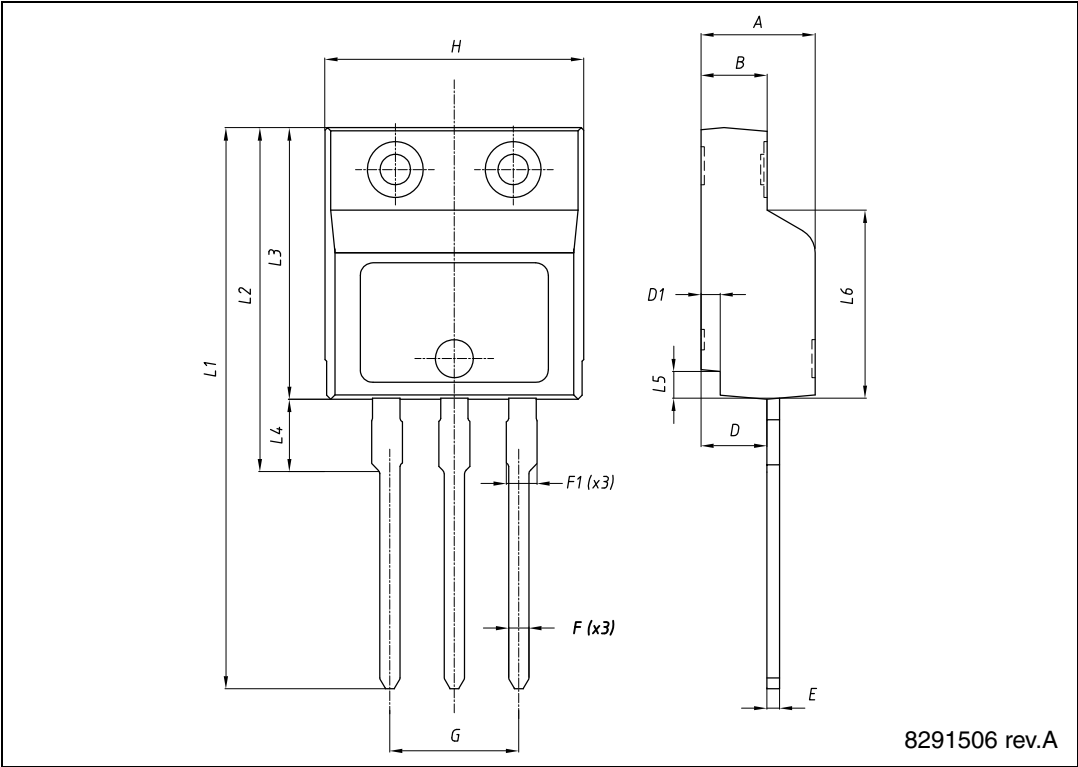


Table 10. H²PAK-2 mechanical data

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°

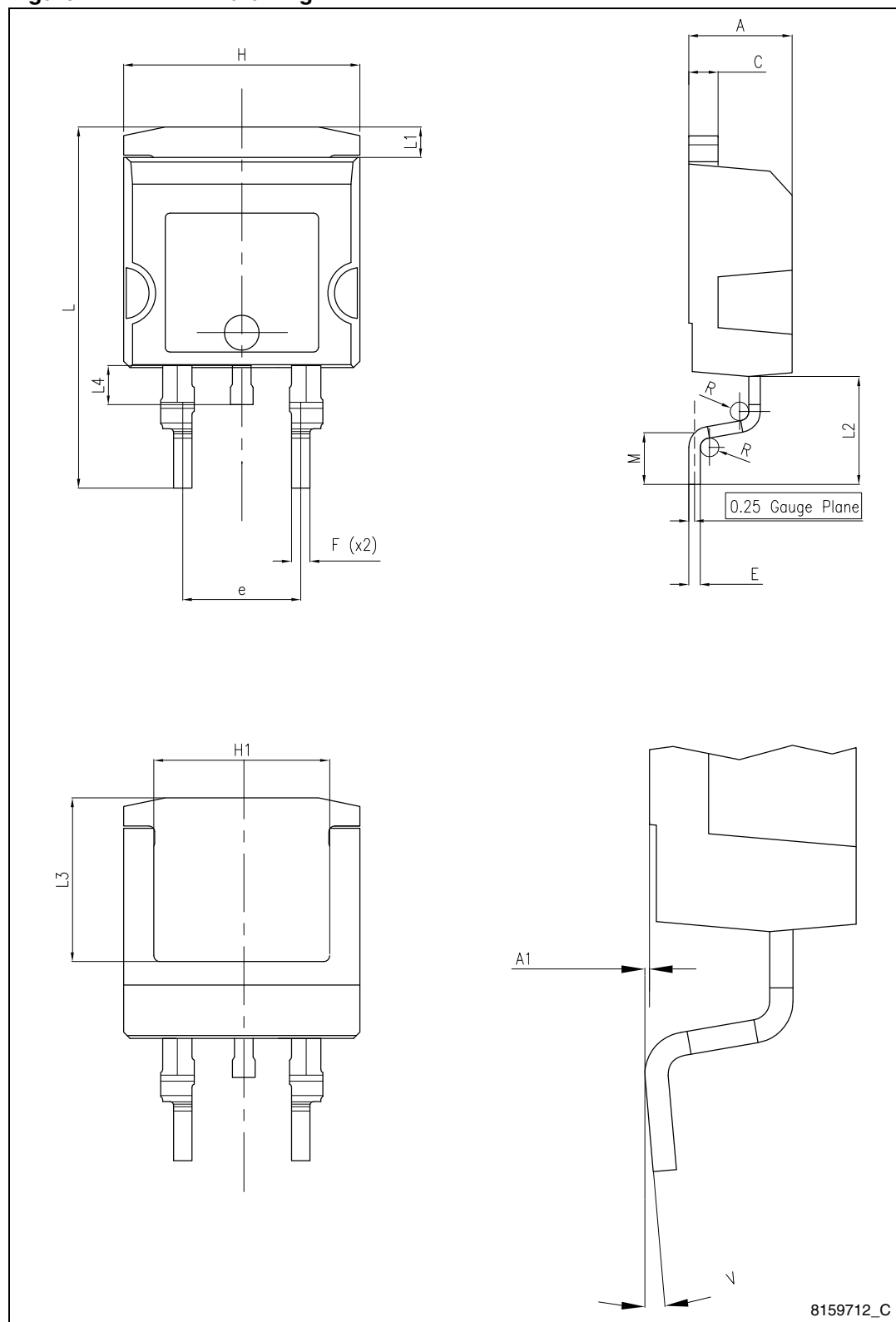
Figure 27. H²PAK-2 drawing

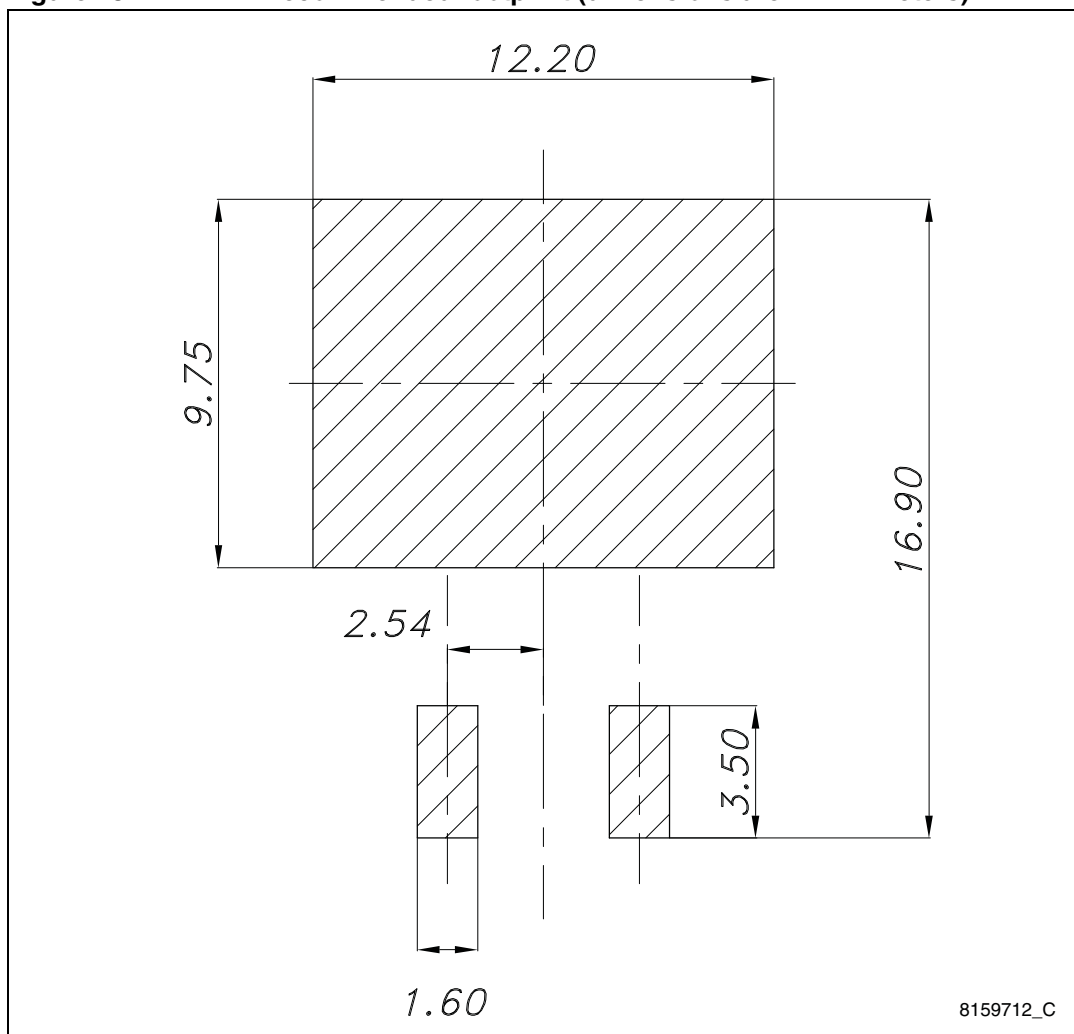
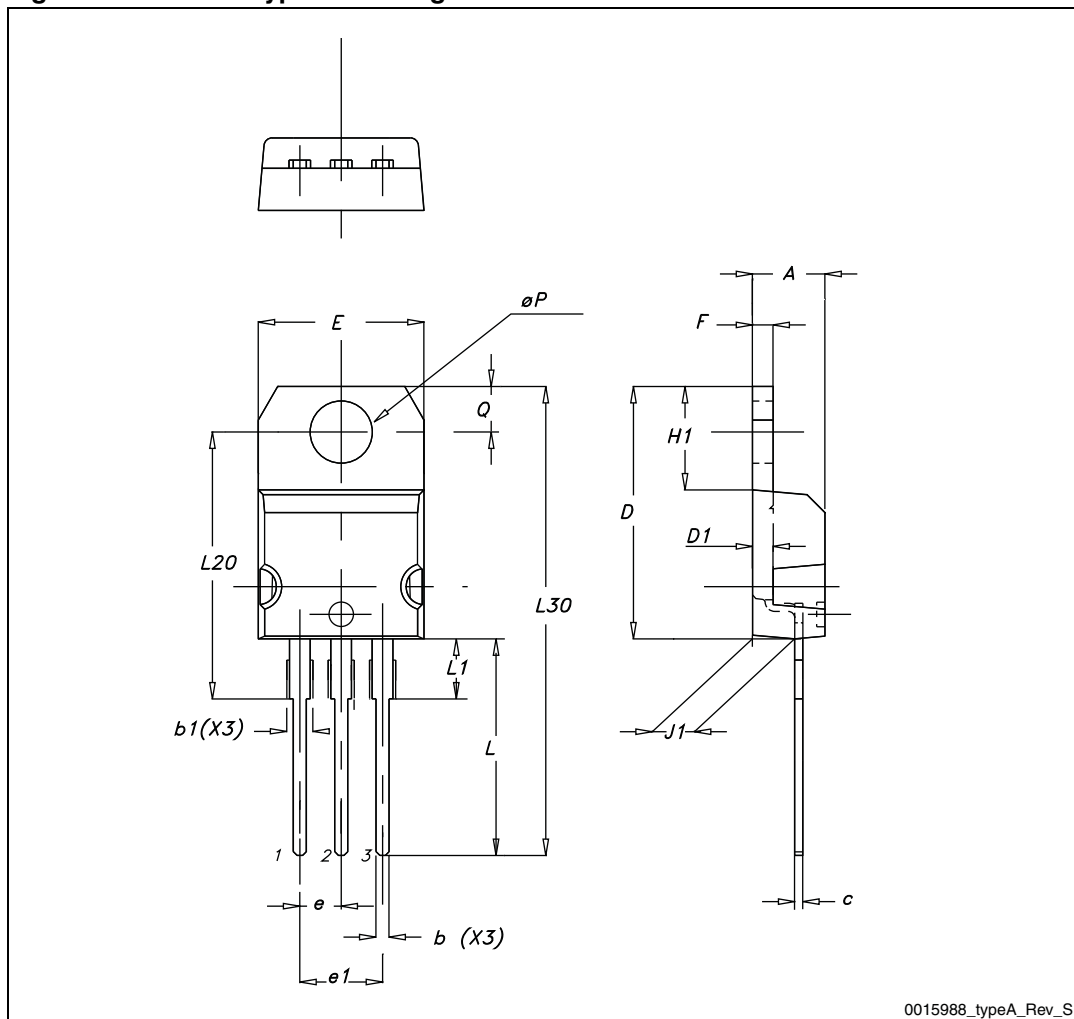
Figure 28. H²PAK-2 recommended footprint (dimensions are in millimeters)

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

Figure 29. TO-220 type A drawing



5 Package mechanical data

Table 12. 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			

Figure 30. Tape

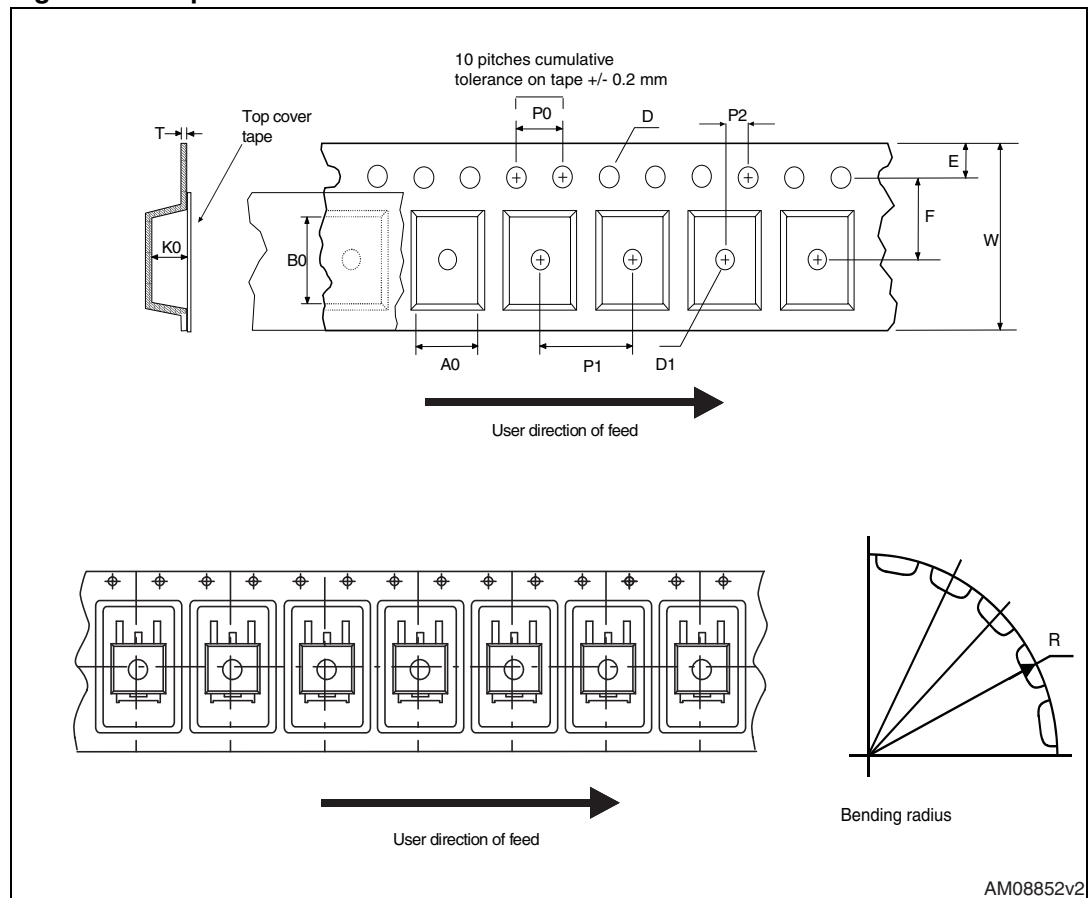
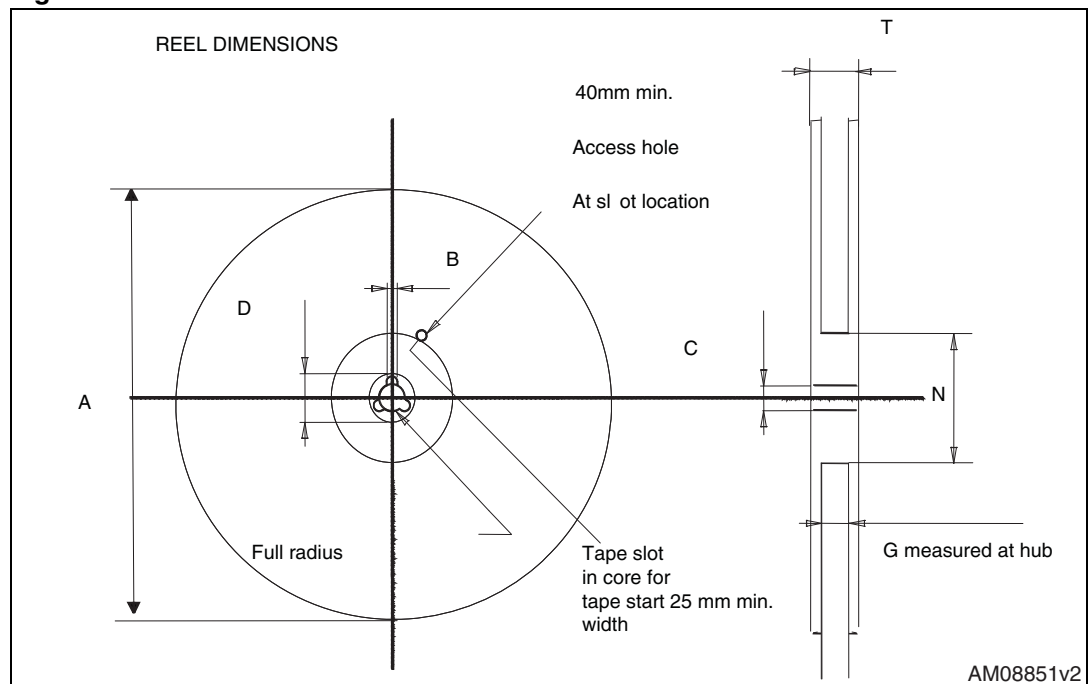


Figure 31. Reel



6 Revision history

Table 13. Document revision history

Date	Revision	Changes
24-Feb-2011	1	First version.
07-May-2012	2	Added Section 2.1: Electrical characteristics (curves) . Minor text changes.
07-Nov-2012	3	Added new device in I ² PAKFP and updated the document accordingly. Updated Section 4: Package mechanical data .

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