STH310N10F7-2, STH310N10F7-6

N-channel 100 V, 1.9 mΩ typ.,180 A, STripFET™ F7 Power MOSFETs in H²PAK-2 and H²PAK-6 packages

Datasheet - production data

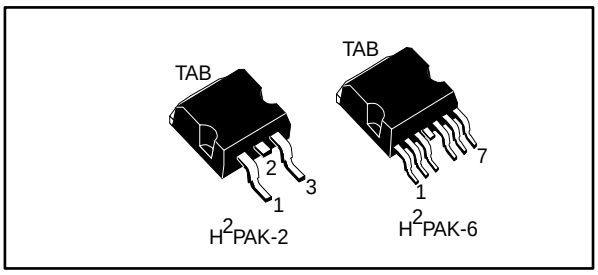
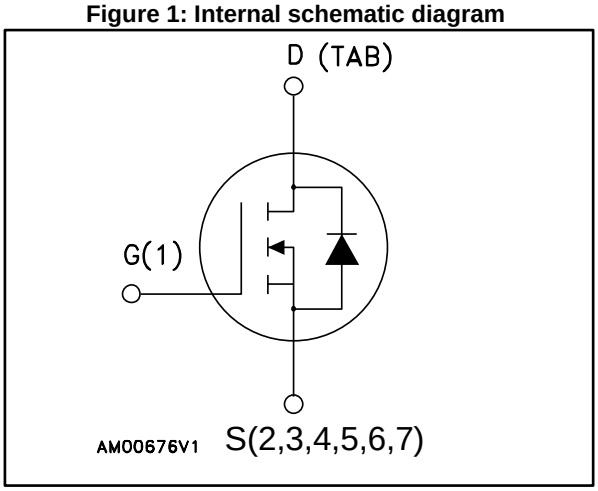


Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STH310N10F7-2	100 V	2.3 mΩ	180 A
STH310N10F7-6			

- Among the lowest $R_{DS(on)}$ on the market
- Excellent figure of merit (FoM)
- Low C_{rss}/C_{iss} ratio for EMI immunity
- High avalanche ruggedness

Description

These N-channel Power MOSFETs utilize STripFET™ F7 technology with an enhanced trench gate structure that results in very low on-resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1: Device summary

Order code	Marking	Package	Packing
STH310N10F7-2	310N10F7	H²PAK-2	Tape and reel
STH310N10F7-6		H²PAK-6	

Contents

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	100	V
V_{GS}	Gate-source voltage	± 20	V
I_D (1)	Drain current (continuous) at T_C = 25 °C	180	A
	Drain current (continuous) at T_C = 100 °C	120	A
I_D (2)	Drain current (pulsed)	720	A
P_{TOT}	Total dissipation at T_C = 25 °C	315	W
	Derating factor	2.1	W/ºC
E_{AS} (3)	Single pulse avalanche energy (T_J = 25 °C L = 0.55 mH, I_{AS} = 65 A)	1	J
T_J	Operating junction temperature	-55 to 175	°C
T_{stg}	Storage temperature		°C

Notes:

(1)Current limited by package

(2)Pulse width limited by safe operating area

(3)Starting T_J = 25 °C, I_D = 60 A, V_{DD} = 50 V

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.48	°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb	35	°C/W

Notes:

(1)When mounted on FR-4 board of 1 inch², 2 oz Cu

2 Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified)

Table 4: On/off-state

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage (V_{GS}= 0)	I_D = 250 µA	100			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 100 V			1	µA
		V_{DS} = 100 V; T_C = 125 °C			100	µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = 20 V			100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2.5	3.5	4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 60 A		1.9	2.3	mΩ

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	12800	-	pF
C_{oss}	Output capacitance			3500		pF
C_{rss}	Reverse transfer capacitance			170		pF
Q_g	Total gate charge	V_{DD} = 50 V, I_D = 180 A V_{GS} = 10 V See *Figure 14: "Gate charge test circuit"*		180		nC
Q_{gs}	Gate-source charge			78		nC
Q_{gd}	Gate-drain charge			34		nC

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 50 V, I_D = 90 A, R_G = 4.7 Ω, V_{GS}= 10 V See *Figure 13: "Switching times test circuit for resistive load"*	-	62	-	ns
t_r	Rise time			108		ns
$t_{d(off)}$	Turn-off delay time			148		ns
t_f	Fall time			40		ns

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		180	A
I_{SDM} (1)	Source-drain current (pulsed)				720	A
V_{SD} (2)	Forward on voltage	I_{SD} = 60 A, V_{GS} = 0			1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 180 A, di/dt = 100 A/µs, V_{DD} = 80 V, T_j = 150 °C		85		ns
Q_{rr}	Reverse recovery charge			200		nC
I_{RRM}	Reverse recovery current			4.7		A

Notes:

(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

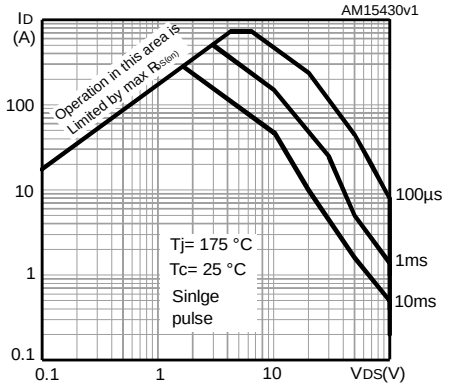


Figure 3: Thermal impedance

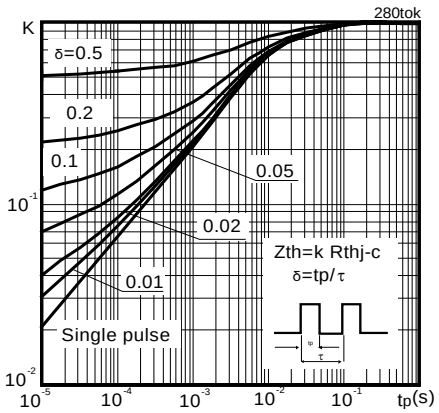


Figure 4: Output characteristics

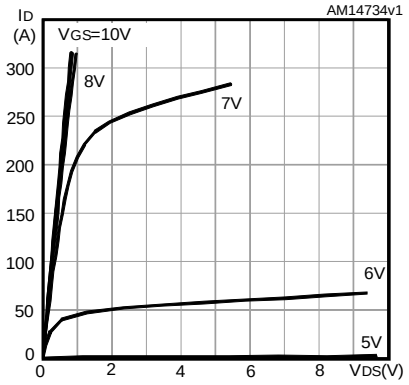


Figure 5: Transfer characteristics

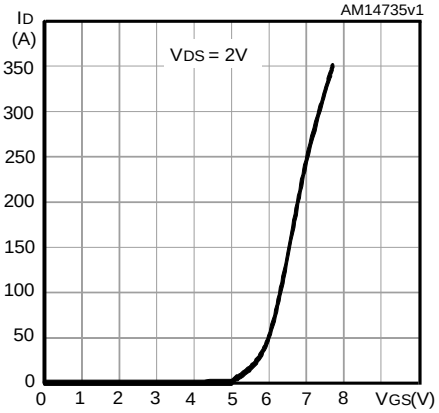


Figure 6: Gate charge vs gate-source voltage

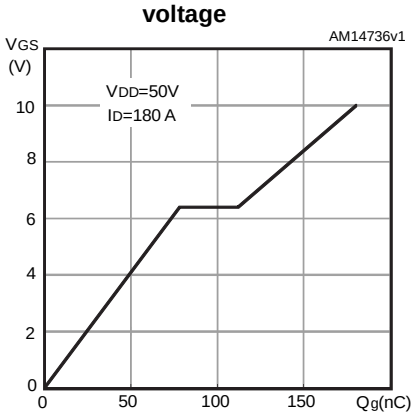


Figure 7: Static drain-source on-resistance

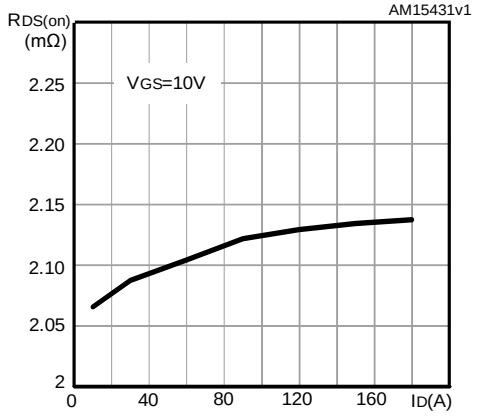


Figure 8: Normalized $V_{(BR)DSS}$ vs temperature

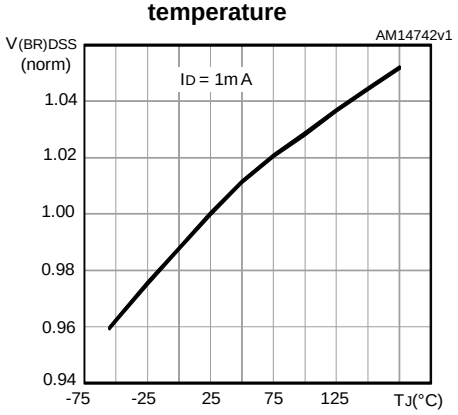


Figure 9: Capacitance variations

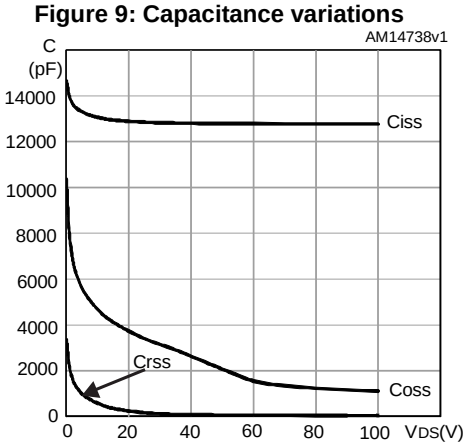


Figure 10: Source-drain diode forward characteristics

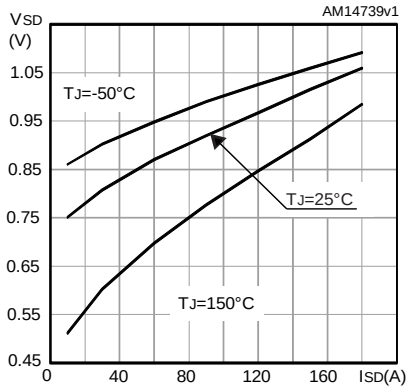


Figure 11: Normalized gate threshold voltage vs temperature

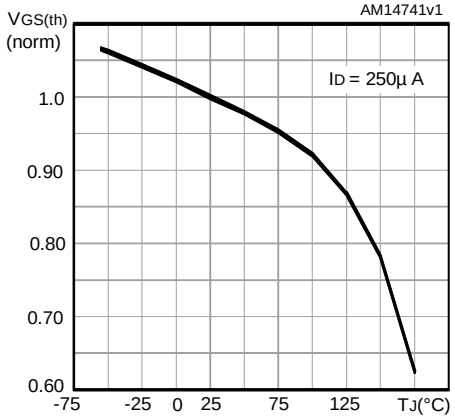
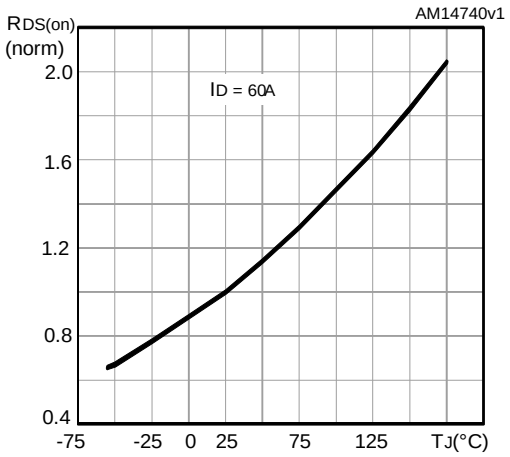


Figure 12: Normalized on-resistance vs temperature



3 Test circuits

Figure 13: Switching times test circuit for resistive load

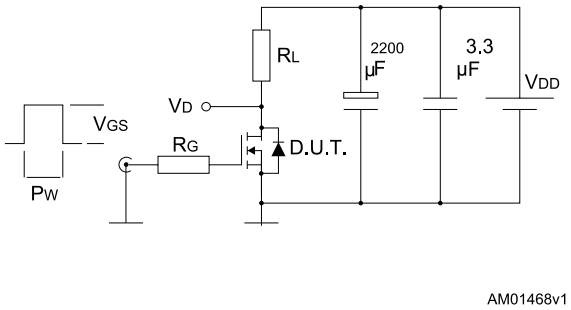


Figure 14: Gate charge test circuit

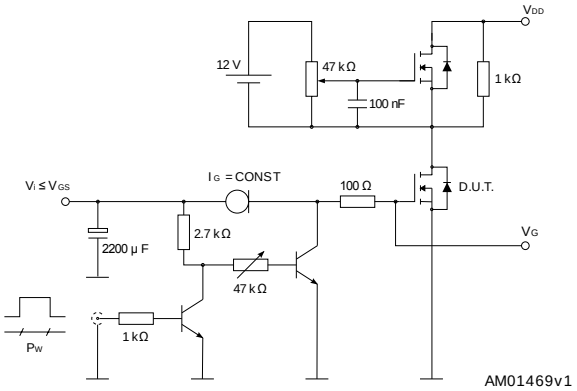


Figure 15: Test circuit for inductive load switching and diode recovery times

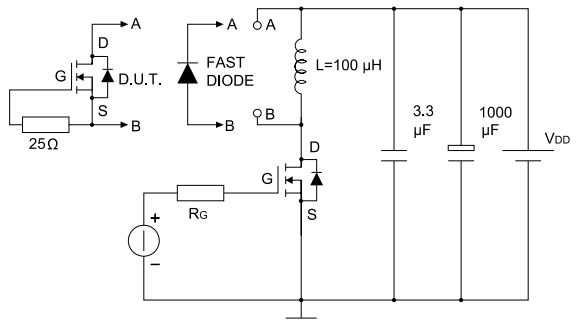


Figure 16: Unclamped inductive load test circuit

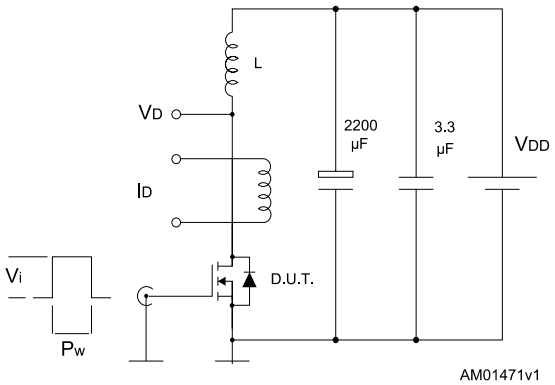


Figure 17: Unclamped inductive waveform

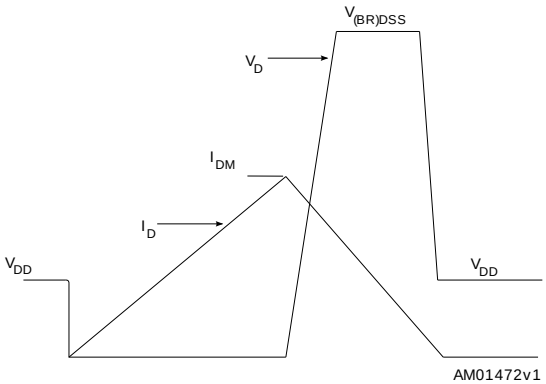
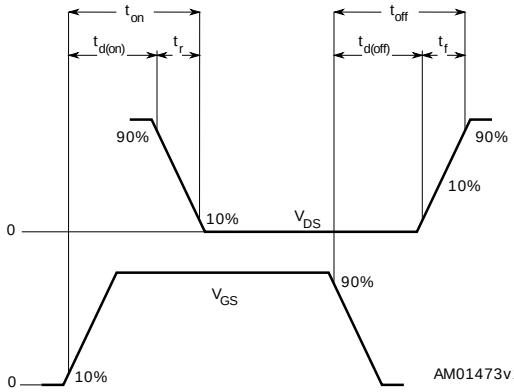


Figure 18: Switching time waveform



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 H²PAK-2 package information

Figure 19: H²PAK-2 outline

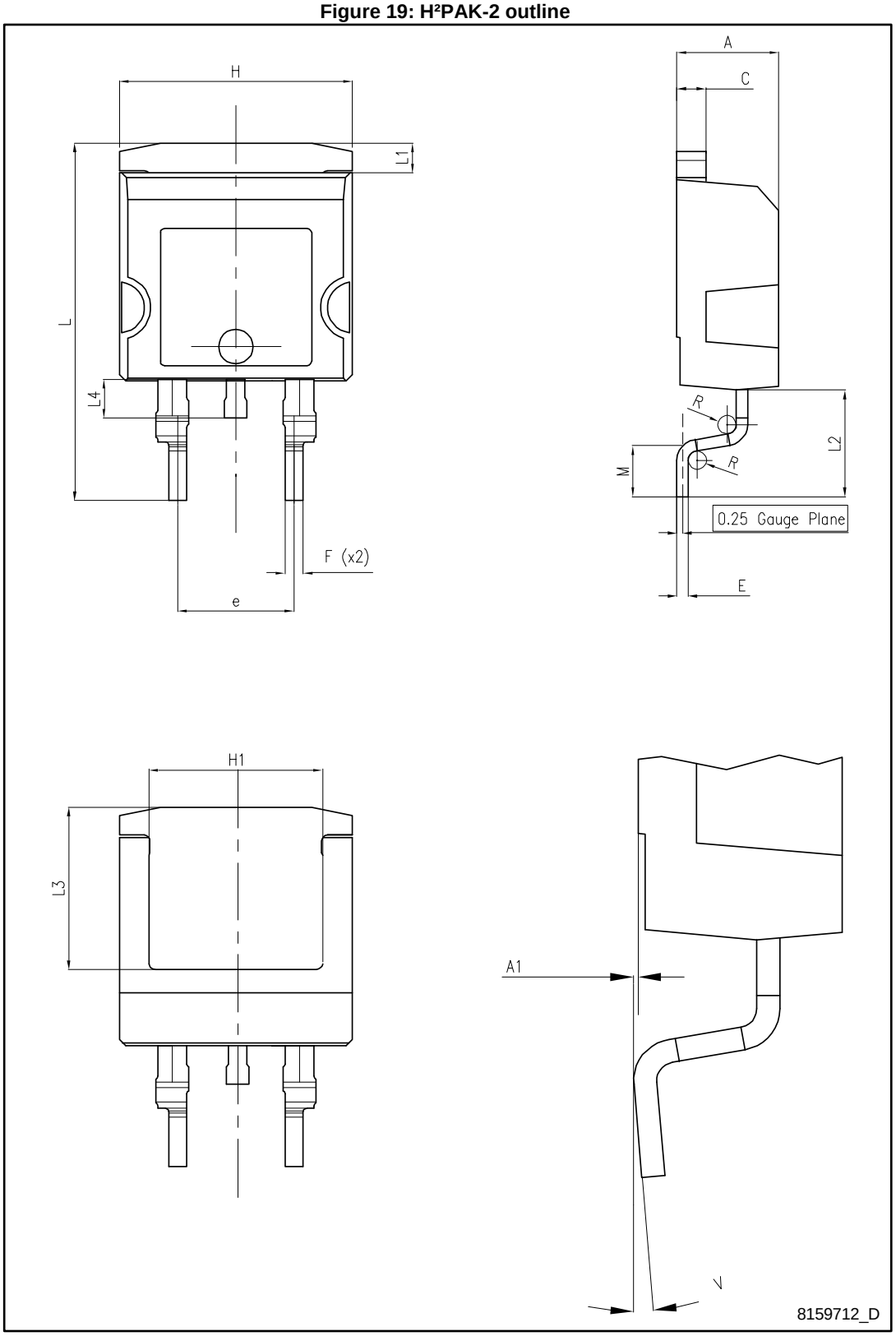
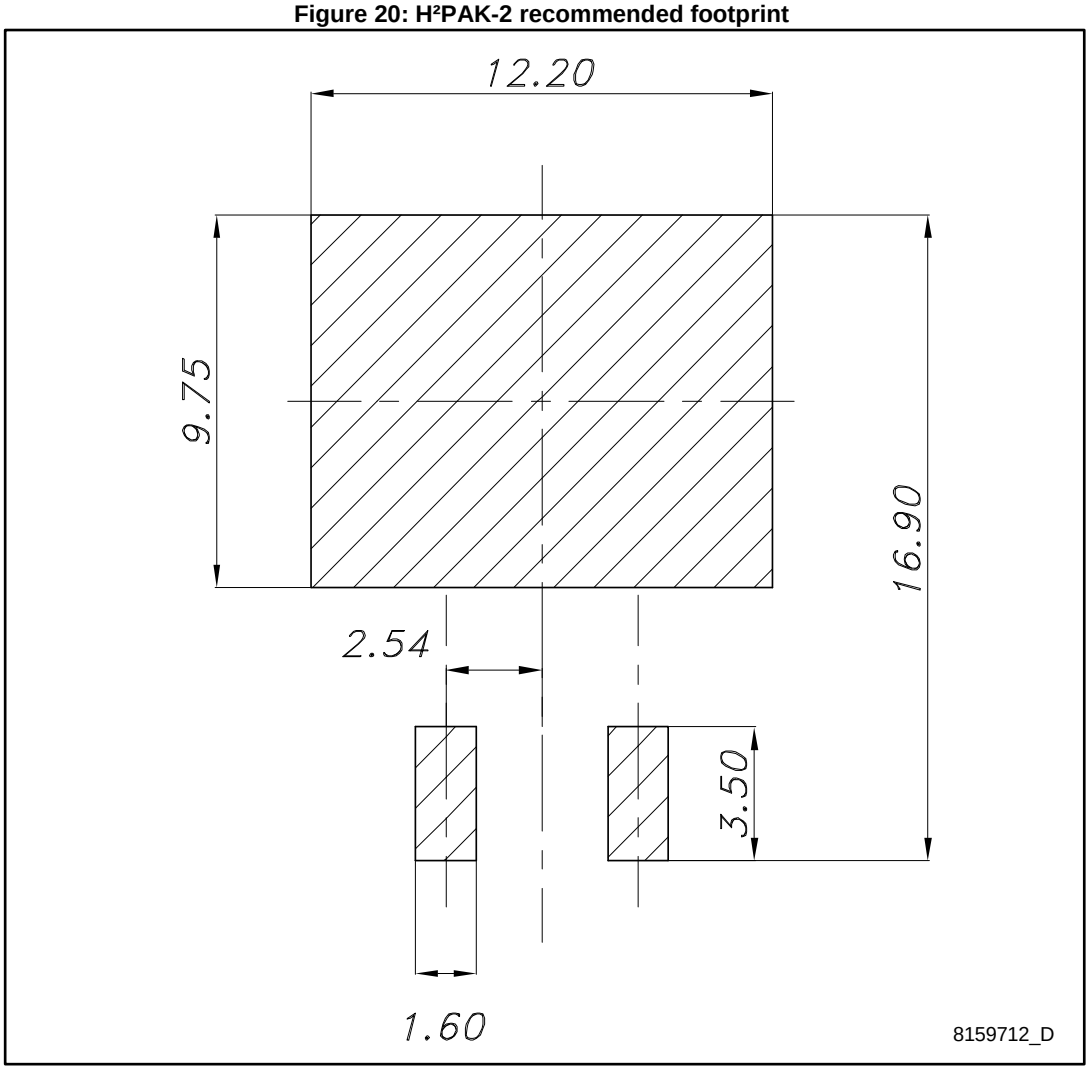


Table 8: H²PAK-2 mechanical data

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 20: H²PAK-2 recommended footprint



4.2 H²PAK-6 package information

Figure 21: H²PAK-6 outline

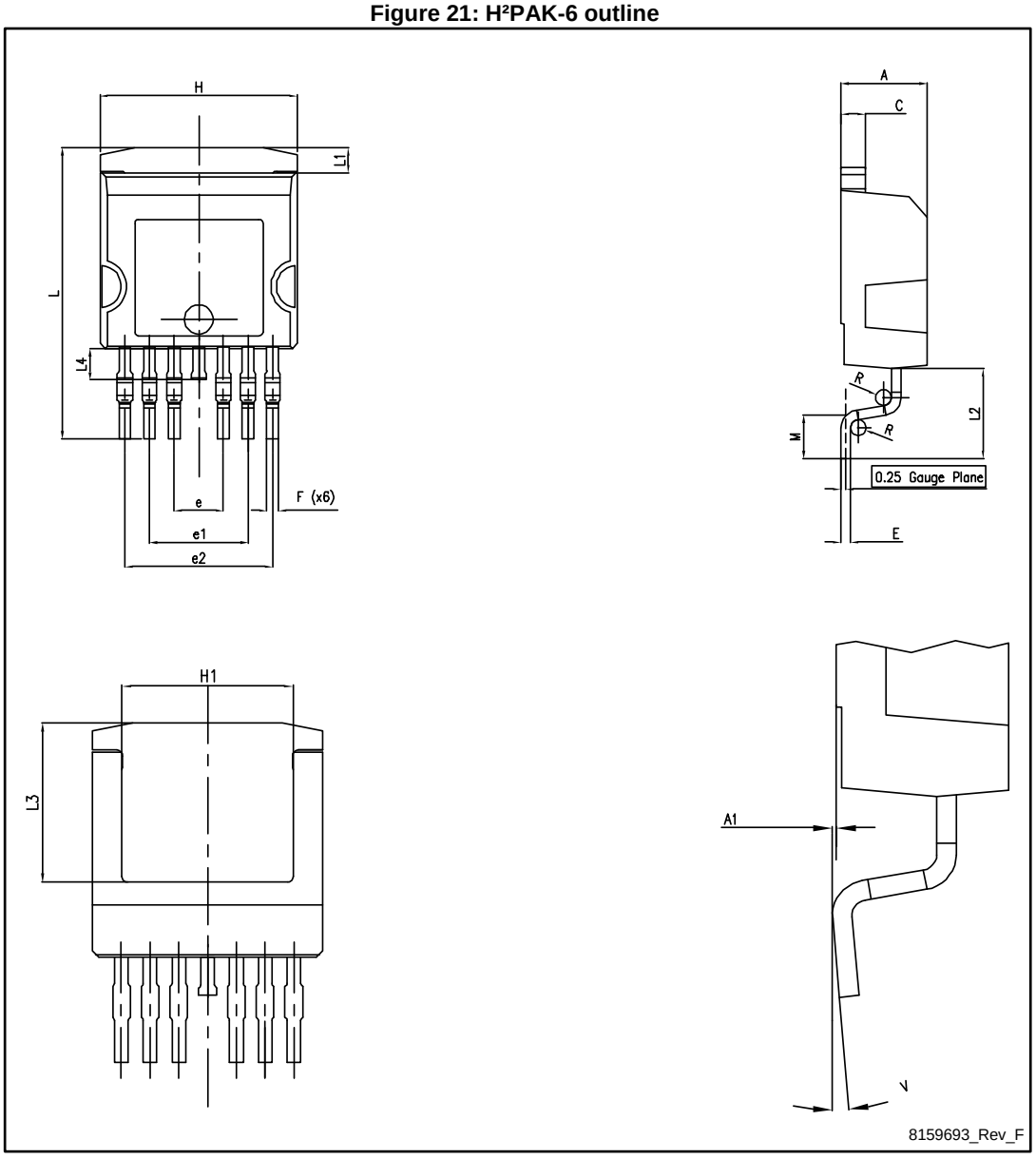
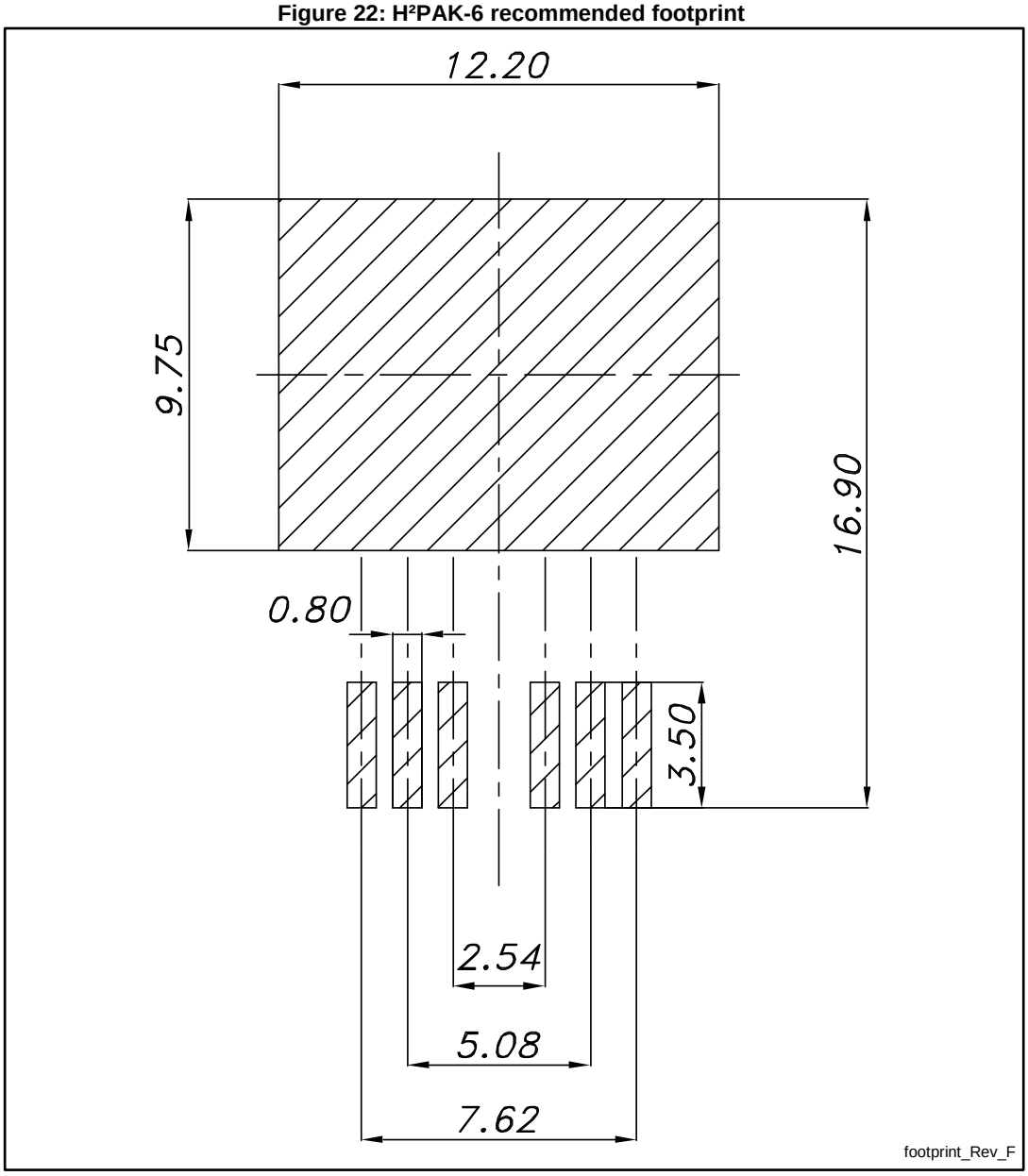


Table 9: H²PAK-6 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.30	-	4.80
A1	0.03		0.20
C	1.17		1.37
e	2.34		2.74
e1	4.88		5.28
e2	7.42		7.82
E	0.45		0.60
F	0.50		0.70
H	10.00		10.40
H1	7.40		7.80
L	14.75		15.25
L1	1.27		1.40
L2	4.35		4.95
L3	6.85		7.25
L4	1.5		1.75
M	1.90		2.50
R	0.20		0.60
V	0°		8°

Figure 22: H²PAK-6 recommended footprint



Dimensions are in mm.

4.3 Packing information

Figure 23: Tape outline

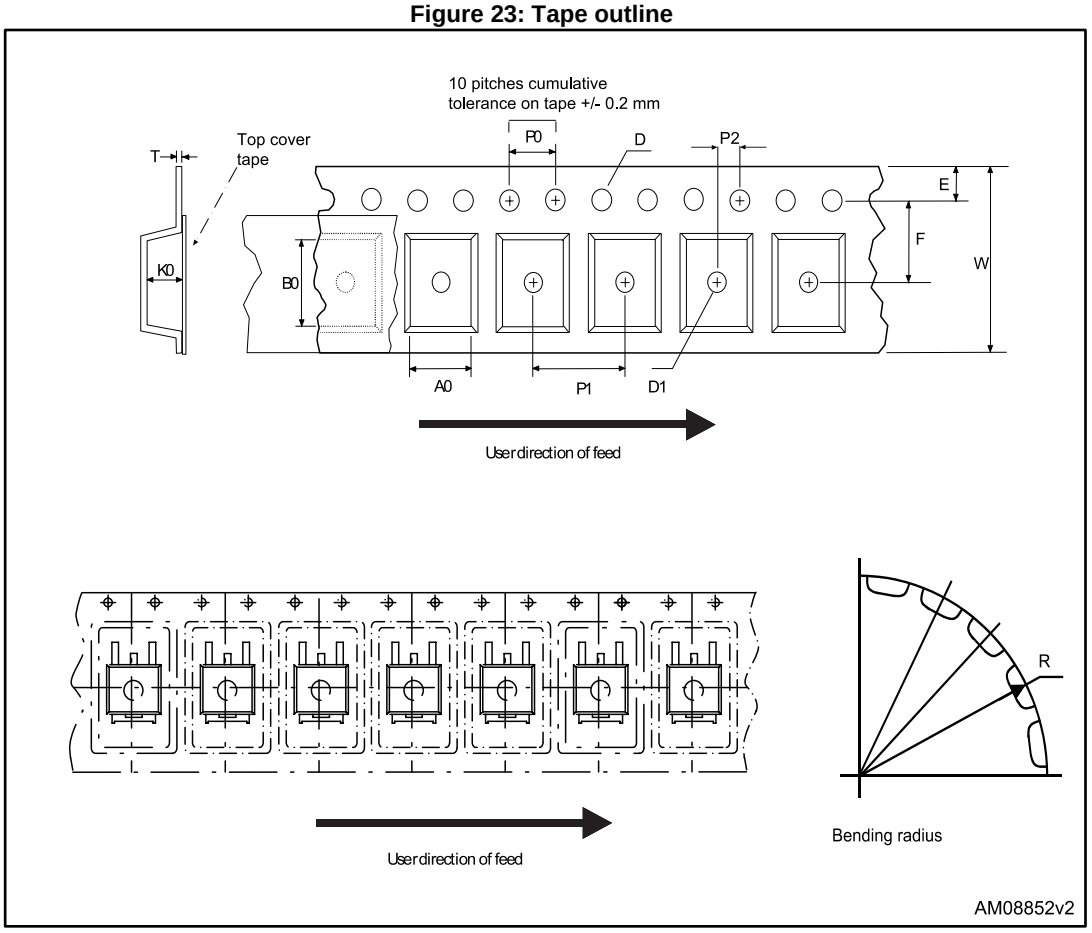


Figure 24: Reel outline

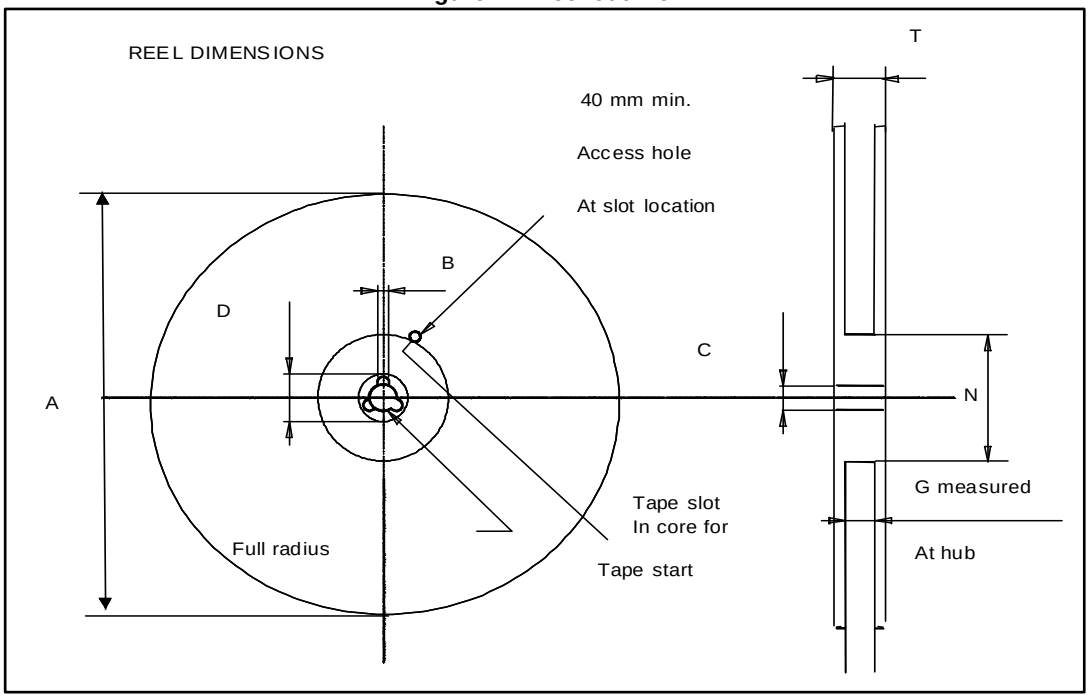


Table 10: Tape and reel mechanical data

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 quantity		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

5 Revision history

Table 11: Document revision history

Date	Revision	Changes
10-Dec-2012	1	Initial release. Part number(s) previously included in datasheet ID02287
23-Jul-2013	2	• Document status promoted from preliminary to production data • Modified: I_{DSS} and V_{GS} value in table 4 • Added: E_{AS} value in table 2 • Minor text changes
27-Nov-2014	3	• Updated: H^2PAK-6 package information. • Updated the title, features and description. • Minor text changes.

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