

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

Datasheet - production data

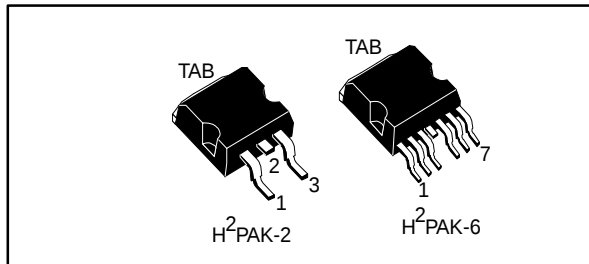
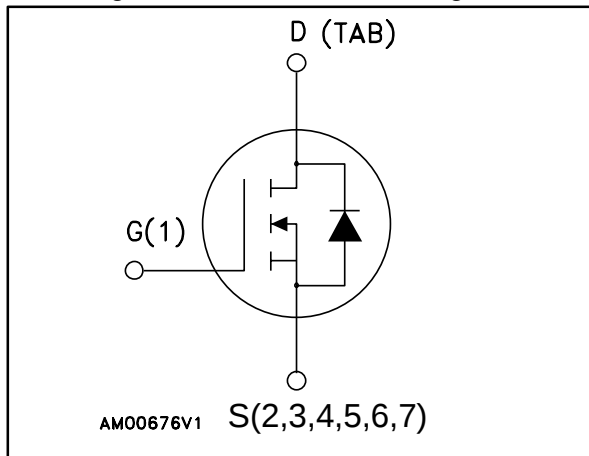


Figure 1: Internal schematic diagram



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

Applications

- Switching applications

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	H ² PAK-2	Tape and reel
STH310N10F7-6		H ² PAK-6	

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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 $T_C = 25\text{ }^{\circ}\text{C}$	180	A
	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	180	A
$I_D^{(2)}$	Drain current (pulsed)	720	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	315	W
$E_{AS}^{(3)}$	Single pulse avalanche energy ($T_J = 25\text{ }^{\circ}\text{C}$ $L = 0.55\text{ mH}$, $I_{AS} = 65\text{ A}$)	1	J
T_J	Operating junction temperature	-55 to 175	$^{\circ}\text{C}$
T_{stg}	Storage temperature		$^{\circ}\text{C}$

Notes:

⁽¹⁾Current limited by package

⁽²⁾Pulse width limited by safe operating area

⁽³⁾Starting $T_J = 25\text{ }^{\circ}\text{C}$, $I_D = 60\text{ A}$, $V_{DD} = 50\text{ V}$

Table 3: Thermal data

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

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		180		nC
Q _{gs}	Gate-source charge	V _{GS} = 10 V		78		nC
Q _{gd}	Gate-drain charge	See Figure 14: "Gate charge test circuit"		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

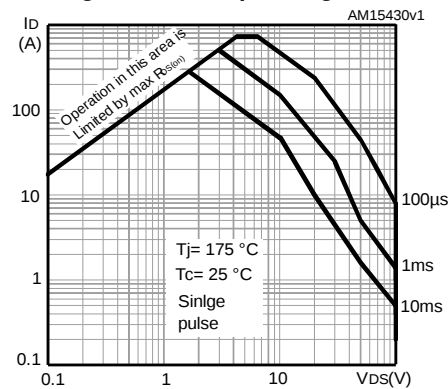


Figure 3: Thermal impedance

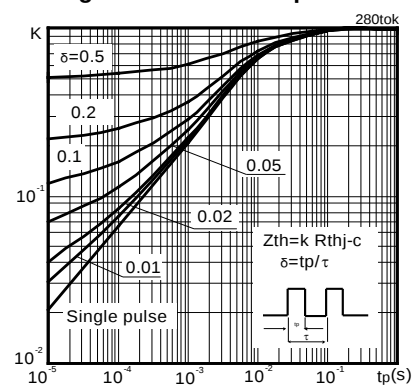


Figure 4: Output characteristics

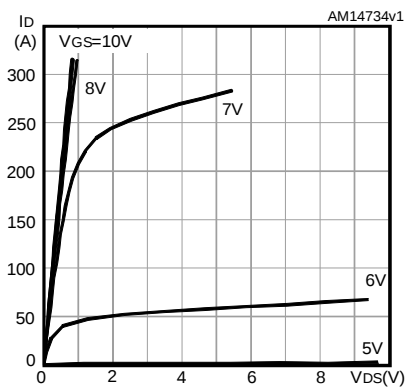


Figure 5: Transfer characteristics

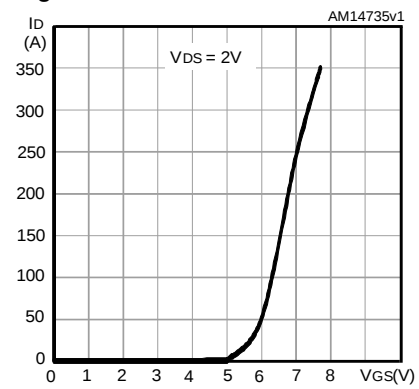


Figure 6: Gate charge vs gate-source voltage

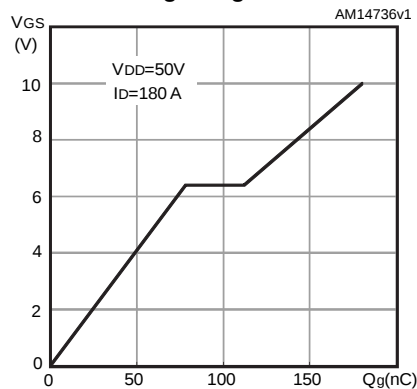


Figure 7: Static drain-source on-resistance

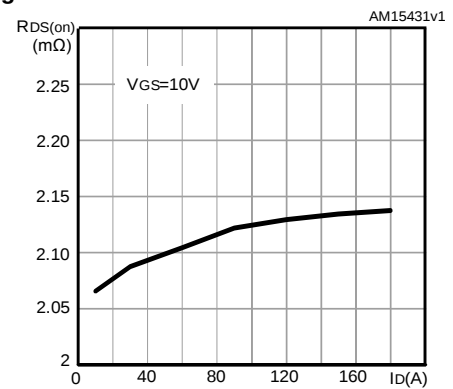


Figure 8: Normalized $V(BR)_{DSS}$ vs temperature

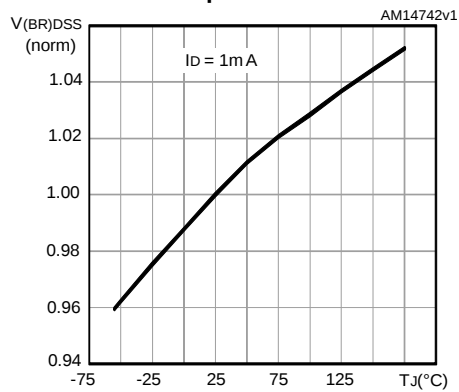


Figure 9: Capacitance variations

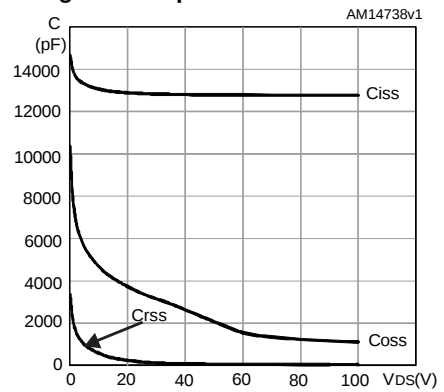


Figure 10: Source-drain diode forward characteristics

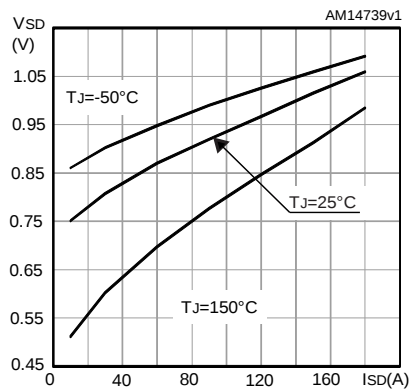


Figure 11: Normalized gate threshold voltage vs temperature

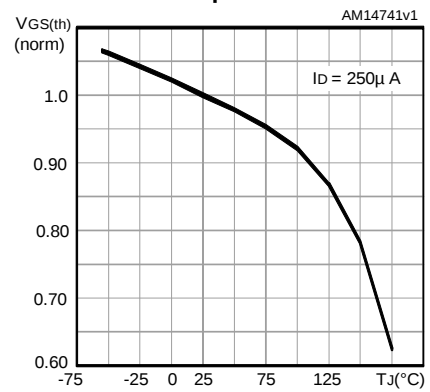
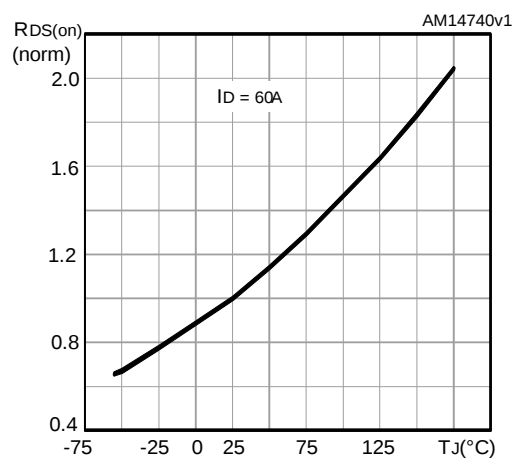
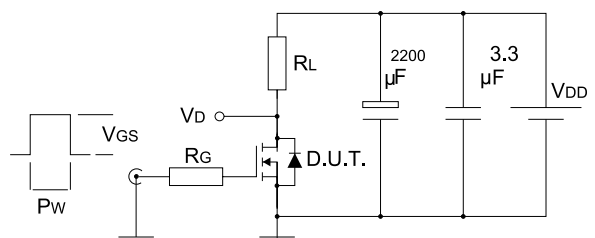


Figure 12: Normalized on-resistance vs temperature



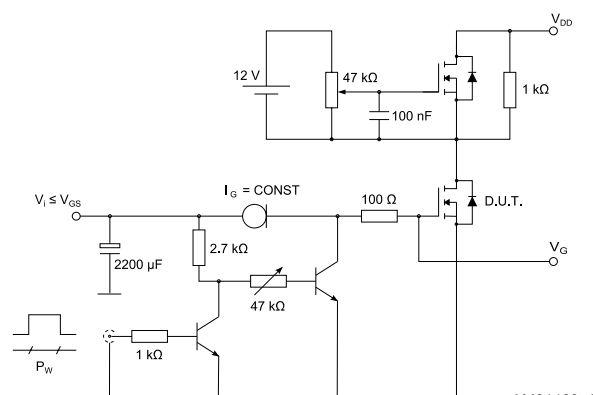
3 Test circuits

Figure 13: Switching times test circuit for resistive load



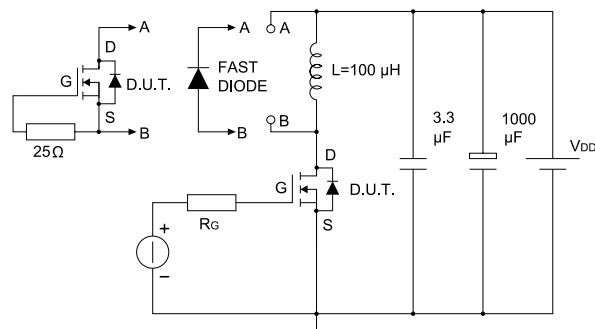
AM01468v1

Figure 14: Gate charge test circuit



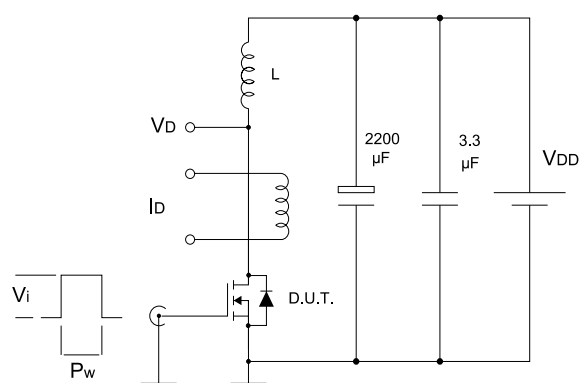
AM01469v1

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



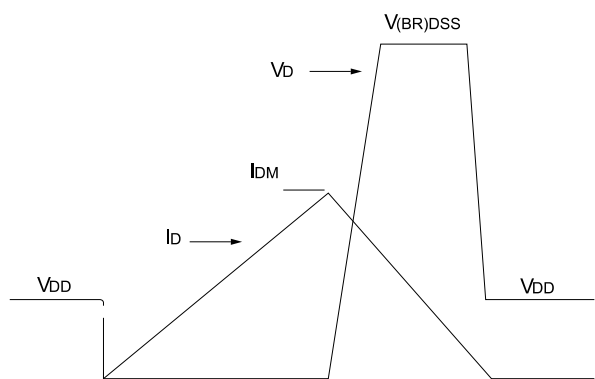
AM01470v1

Figure 16: Unclamped inductive load test circuit



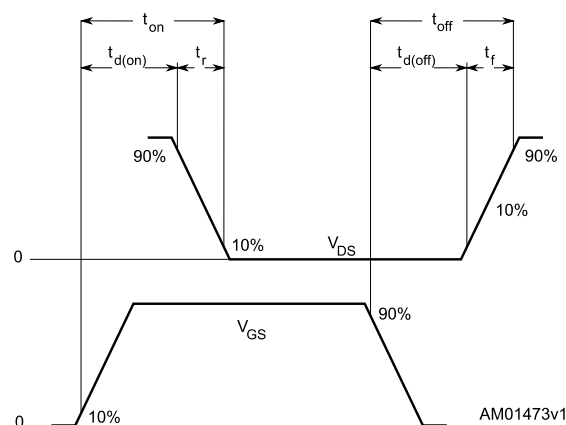
AM01471v1

Figure 17: Unclamped inductive waveform



AM01472v1

Figure 18: Switching time waveform



AM01473v1

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

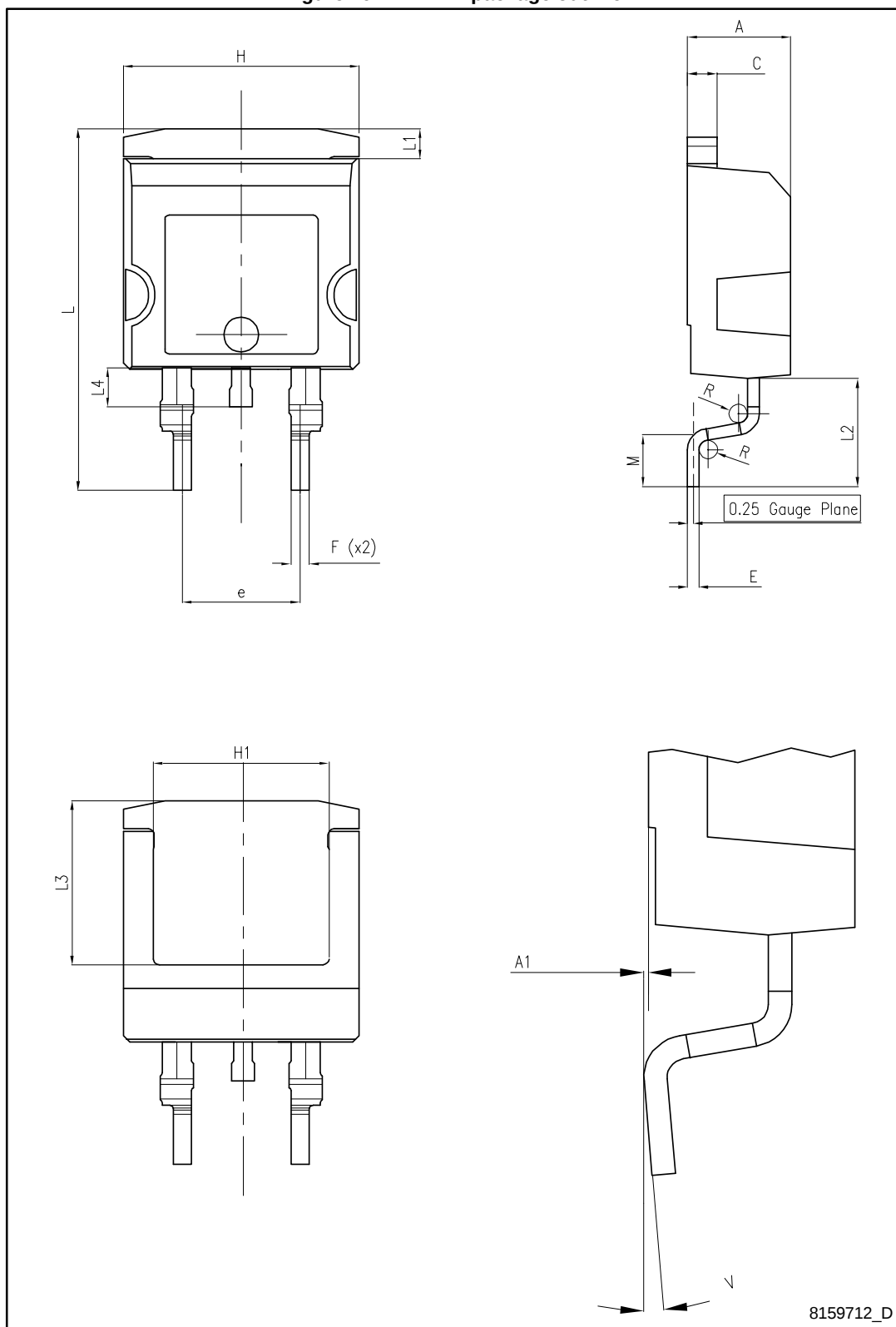
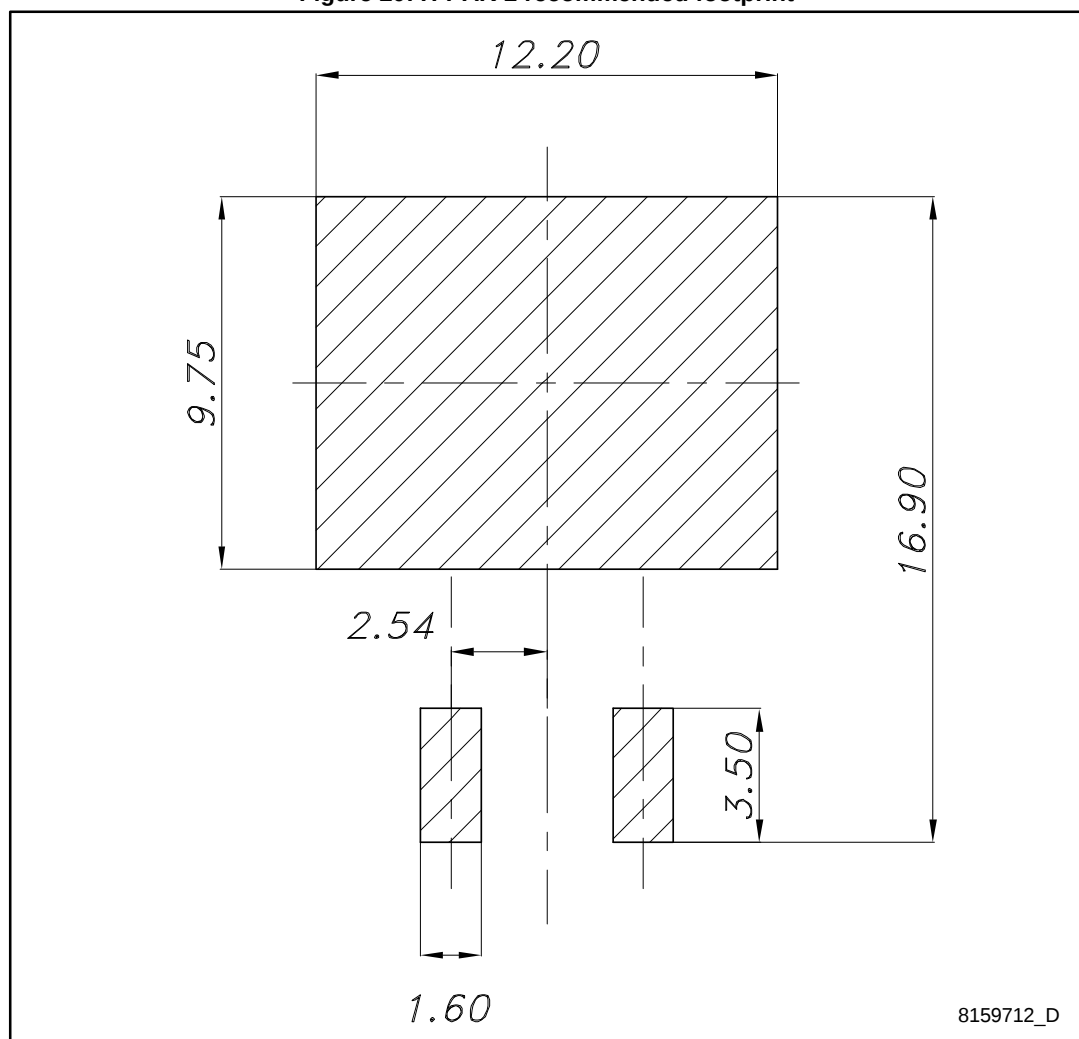
Figure 19: H²PAK-2 package outline

Table 8: H²PAK-2 package 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 package outline

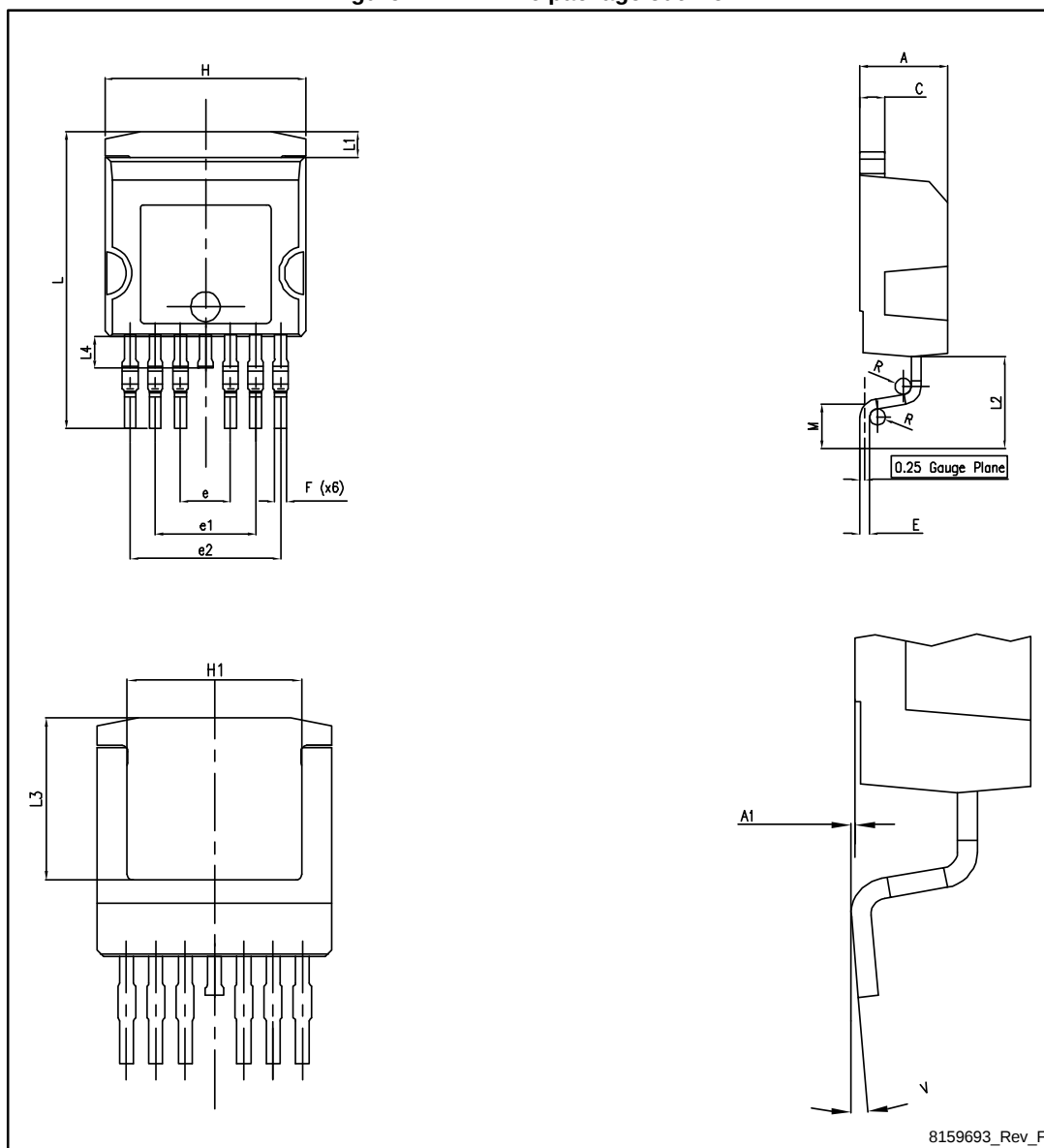
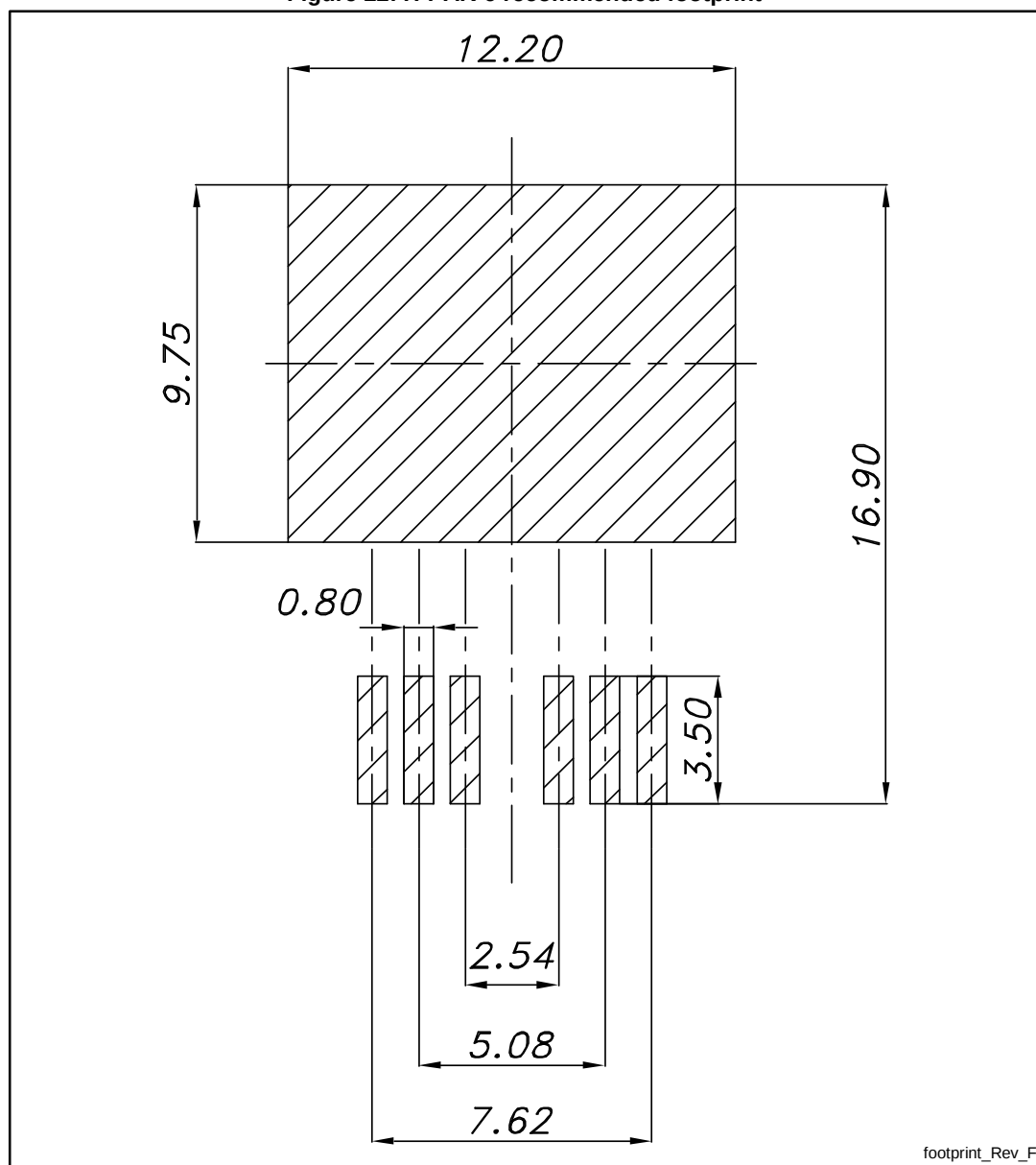


Table 9: H²PAK-6 package mechanical data

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

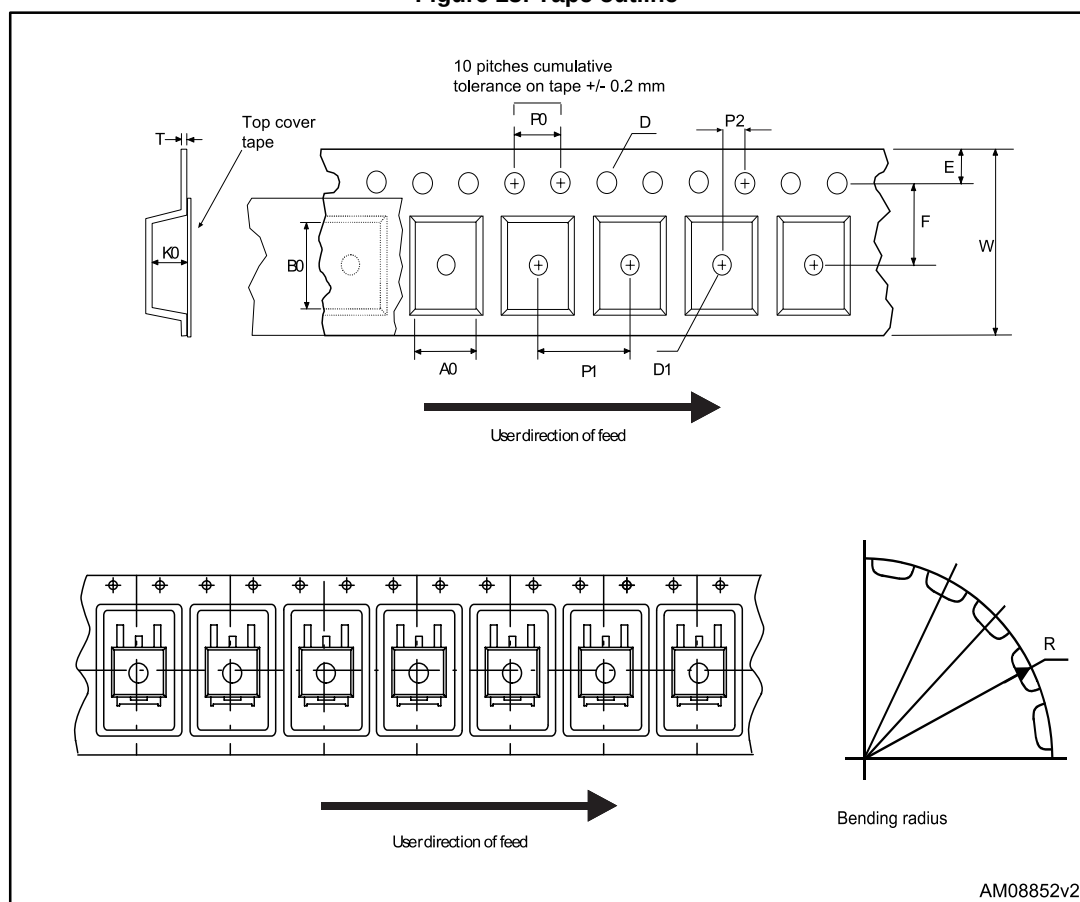
Figure 23: Tape outline

Figure 24: Reel outline

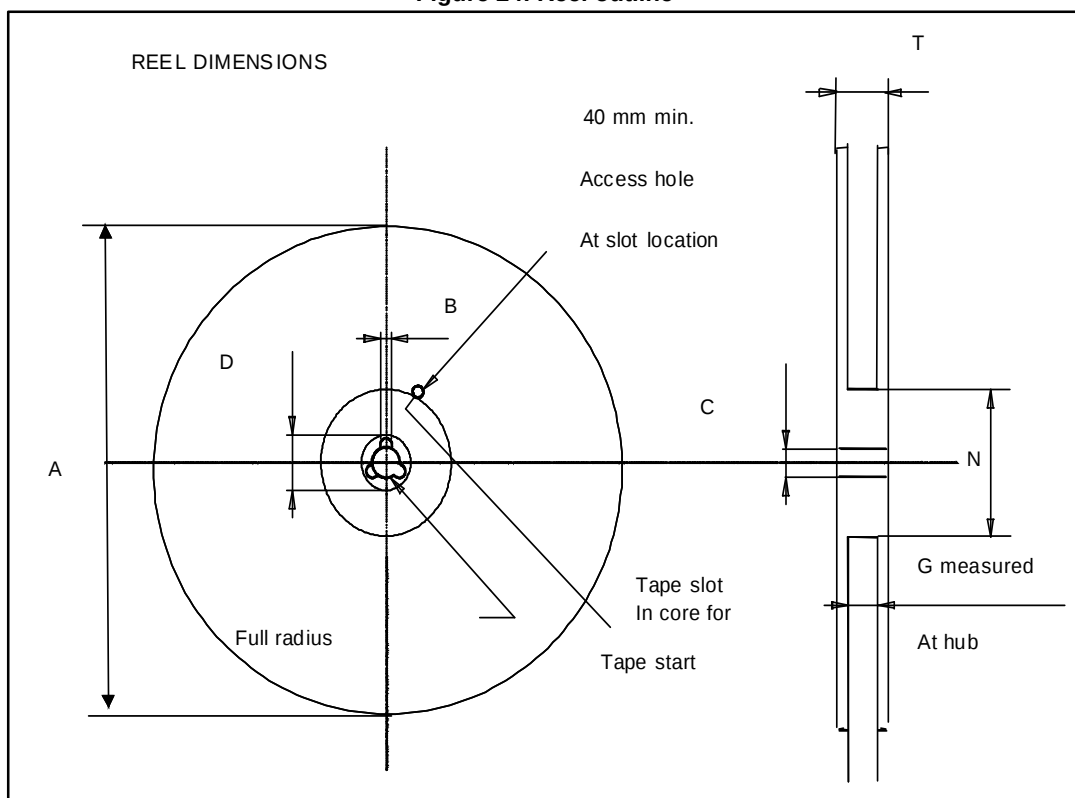


Table 10: Tape and reel mechanical data

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: H²PAK-6 package information. • Updated the title, features and description. • Minor text changes.
29-Jul-2015	4	Updated Table 2: "Absolute maximum ratings" .

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