

N-channel 100 V, 4.9 mΩ typ., 110 A, STripFET™ F7 Power MOSFETs in H²PAK-2 and H²PAK-6 packages

Datasheet - production data

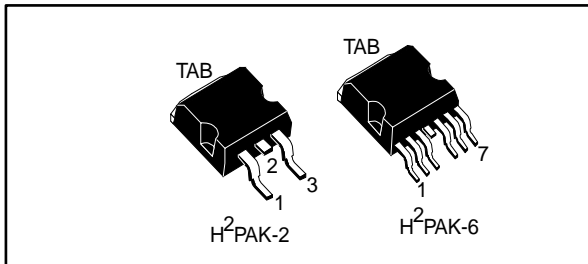
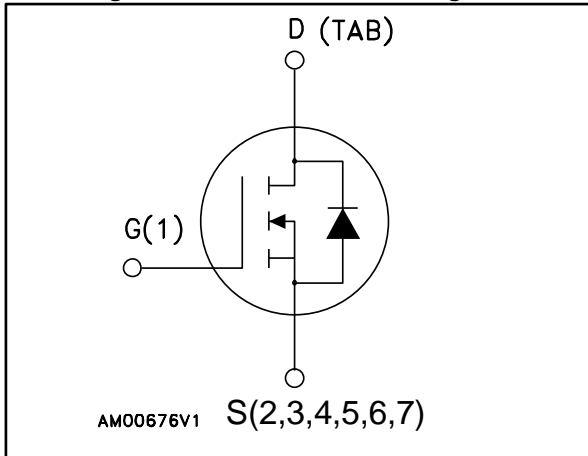


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STH110N10F7-2	100 V	6.5 mΩ	110 A	150 W
STH110N10F7-6				

- 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
STH110N10F7-2	110N10F7	H ² PAK-2	Tape and reel
STH110N10F7-6		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 $T_C = 25\text{ }^\circ\text{C}$	110	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	76	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	18	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	13	A
$I_{DM}^{(3)}$	Drain current (pulsed)	430	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	150	W
$E_{AS}^{(4)}$	Single pulse avalanche energy	490	mJ
T_J	Operating junction temperature	-55 to 175	$^\circ\text{C}$
T_{stg}	Storage temperature		$^\circ\text{C}$

Notes:

- (1) This value is rated according to R_{thj-c}
 (2) This value is rated according to $R_{thj-pcb}$
 (3) Pulse width limited by safe operating area
 (4) Starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = 18$, $V_{DD} = 50\text{ V}$

Table 3: Thermal resistance

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

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

Table 4: On/off-state

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ($V_{GS} = 0$)	$I_D = 250\text{ }\mu\text{A}$	100			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 100\text{ V}$			1	μA
		$V_{DS} = 100\text{ V};$ $T_C = 125\text{ °C}$			100	μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = 20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.5		4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 55\text{ A}$		4.9	6.5	m Ω

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
C_{iss}	Input capacitance	$V_{DS} = 50\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$	-	5117	-	pF	
C_{oss}	Output capacitance			992		pF	
C_{rss}	Reverse transfer capacitance			39		pF	
Q_g	Total gate charge			$V_{DD} = 50\text{ V}, I_D = 110\text{ A}$		72	nC
Q_{gs}	Gate-source charge			$V_{GS} = 10\text{ V}$		31	nC
Q_{gd}	Gate-drain charge			See Figure 14: "Gate charge test circuit"		16	nC

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 50\text{ V}, I_D = 55\text{ A},$ $R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ See Figure 13: "Switching times test circuit for resistive load"	-	25	-	ns
t_r	Rise time			36		ns
$t_{d(off)}$	Turn-off delay time			52		ns
t_f	Fall time			21		ns

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		110	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				430	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 55 \text{ A}, V_{GS} = 0$			1.2	V
t_{rr}	Reverse recovery time	$I_{SD} = 110 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 80 \text{ V},$ $T_j = 150 \text{ }^\circ\text{C}$			77	ns
Q_{rr}	Reverse recovery charge				150	nC
I_{RRM}	Reverse recovery current				4.3	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)

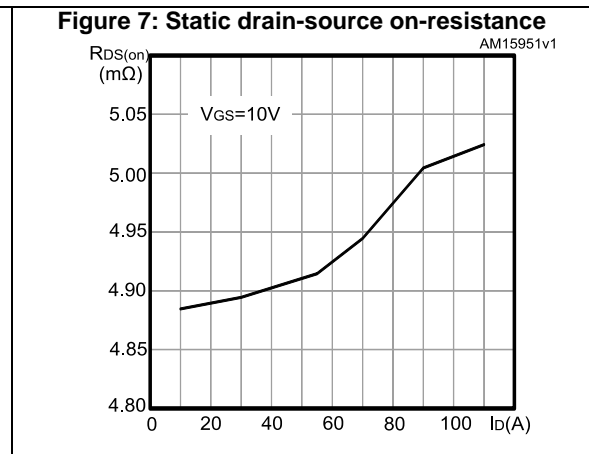
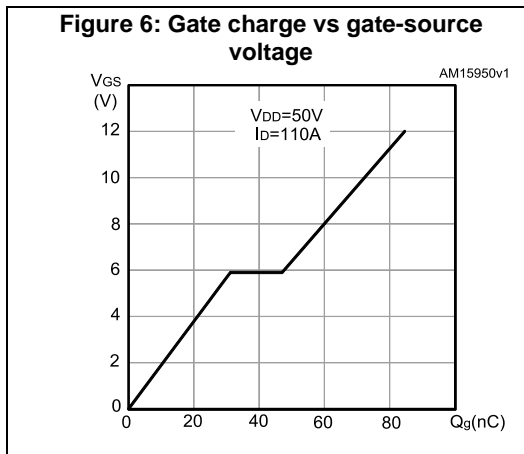
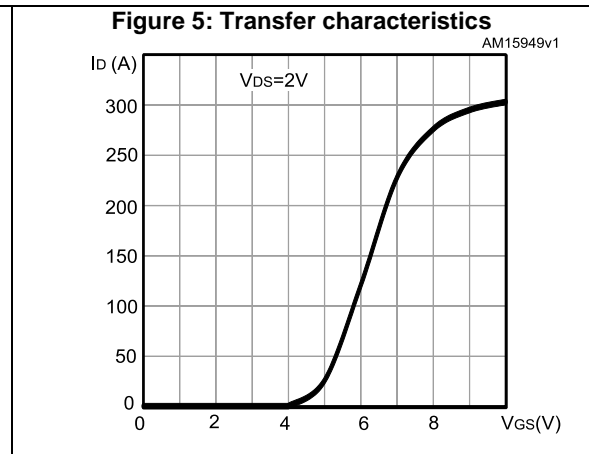
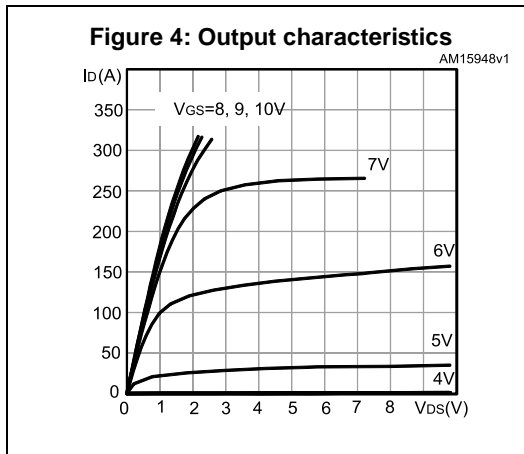
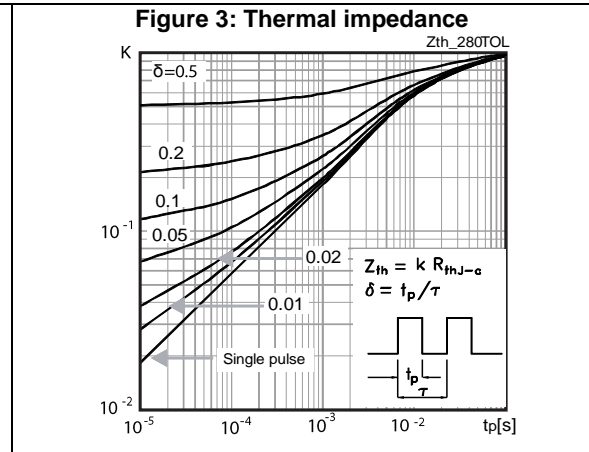
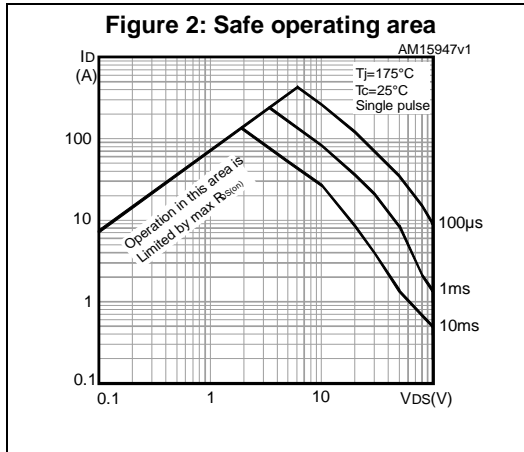


Figure 8: Capacitance variations

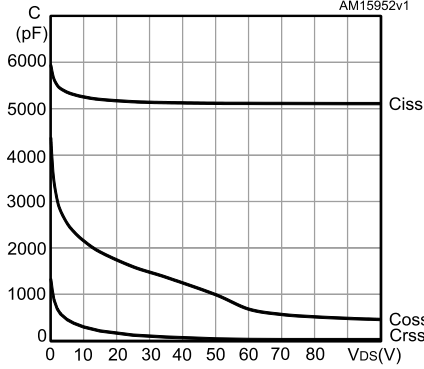


Figure 9: Normalized gate threshold voltage vs temperature

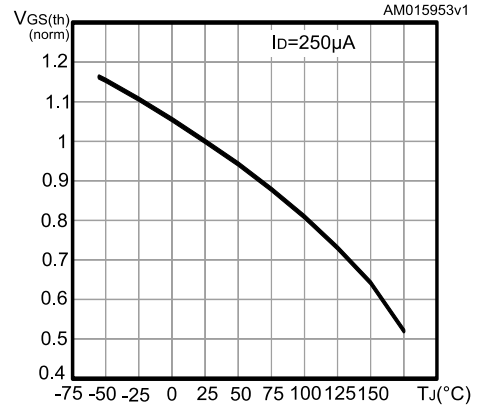


Figure 10: Normalized on-resistance vs temperature

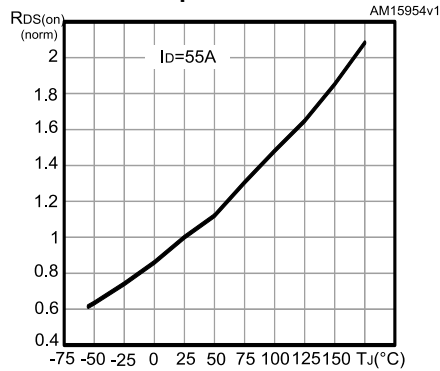


Figure 11: Normalized V(BR)DSS vs temperature

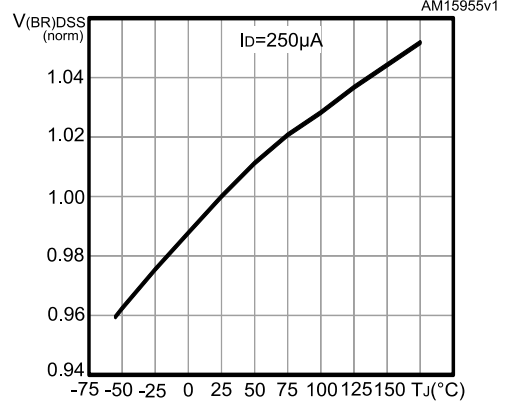
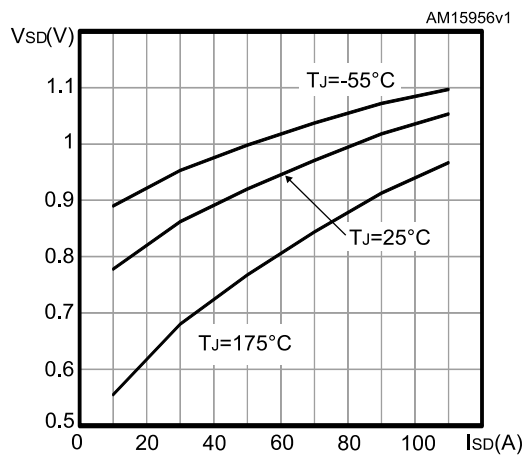


Figure 12: Source-drain diode forward characteristics



3 Test circuits

Figure 13: Switching times test circuit for resistive load

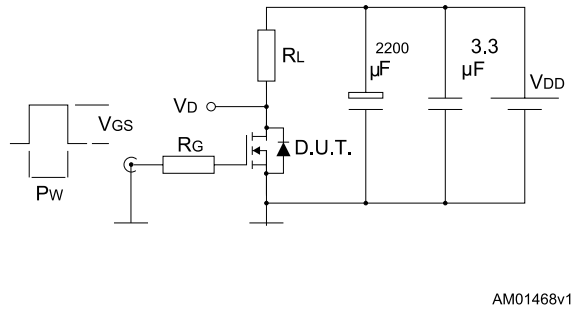


Figure 14: Gate charge test circuit

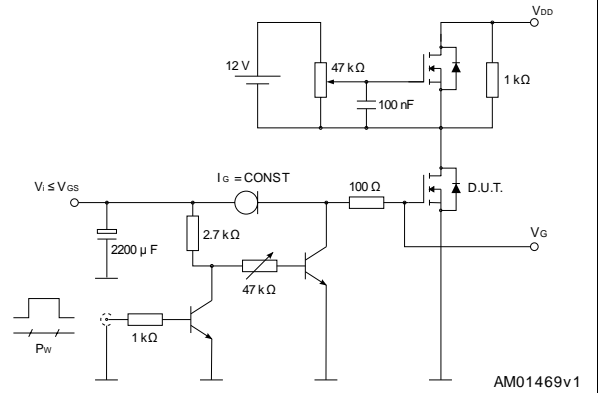


Figure 15: Test circuit for inductive load switching and diode recovery times

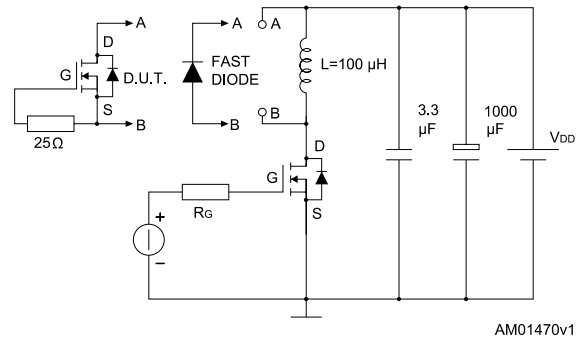


Figure 16: Unclamped inductive load test circuit

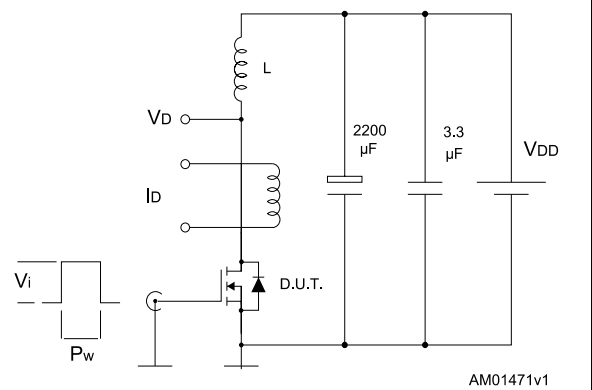


Figure 17: Unclamped inductive waveform

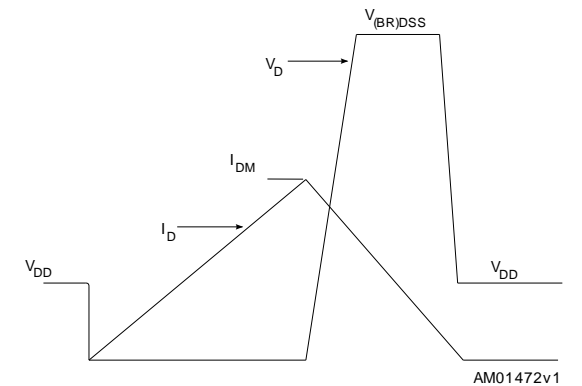
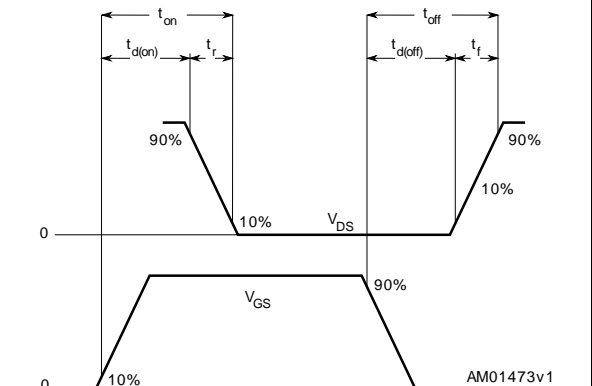


Figure 18: Switching time waveform

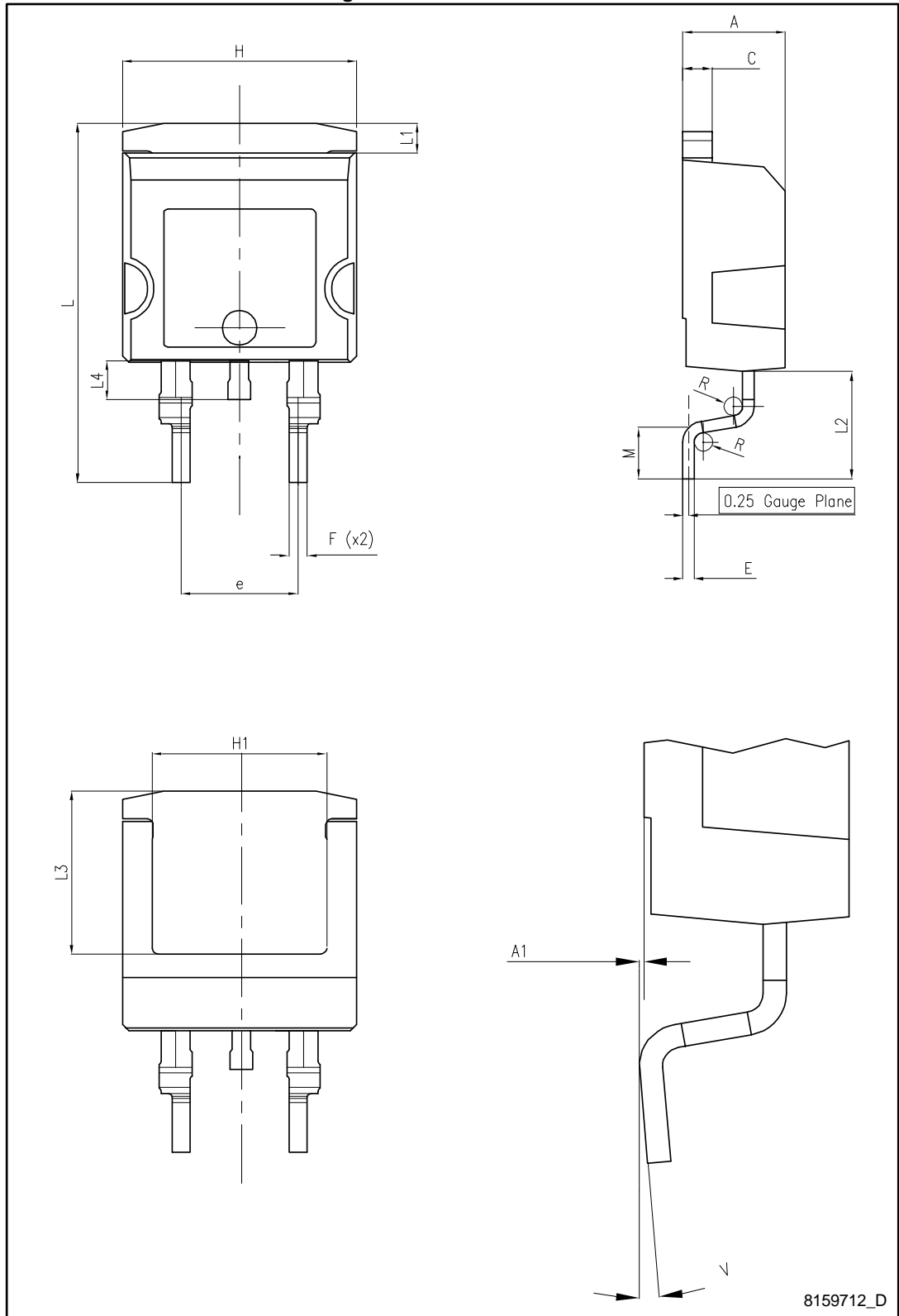


4 Package information

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

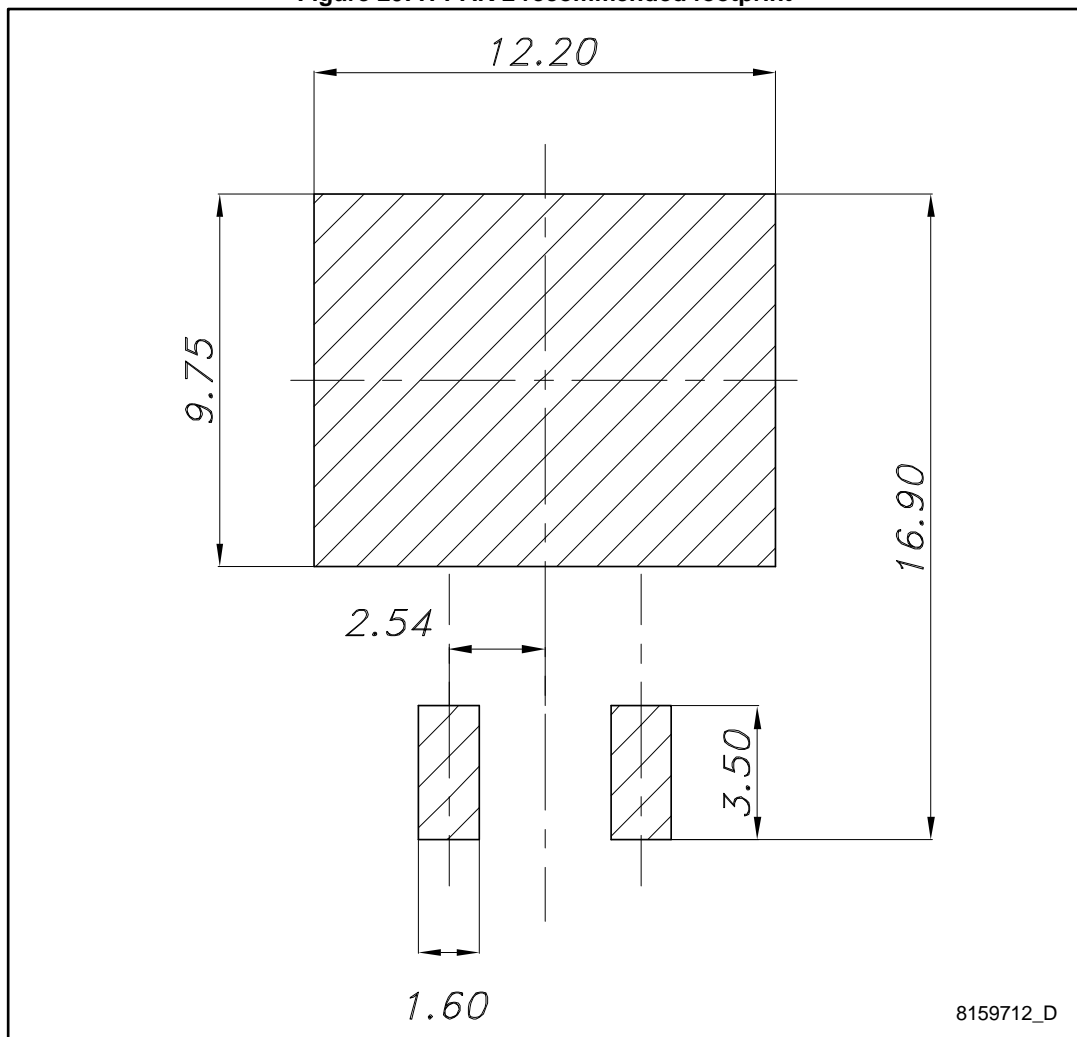


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Table 8: H²PAK-2 mechanical data

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°

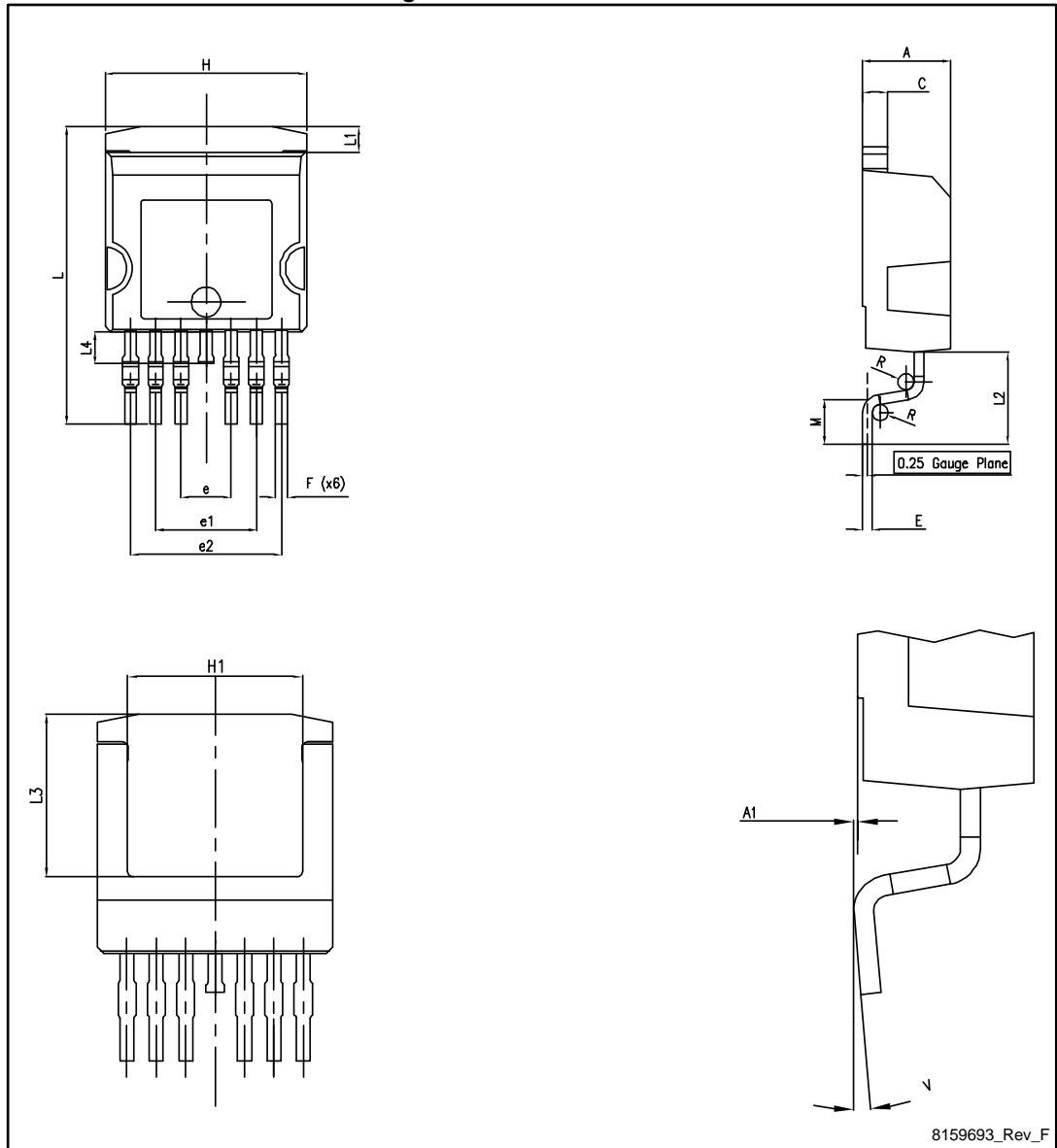
Figure 20: H²PAK-2 recommended footprint



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4.2 H²PAK-6 package information

Figure 21: H²PAK-6 outline

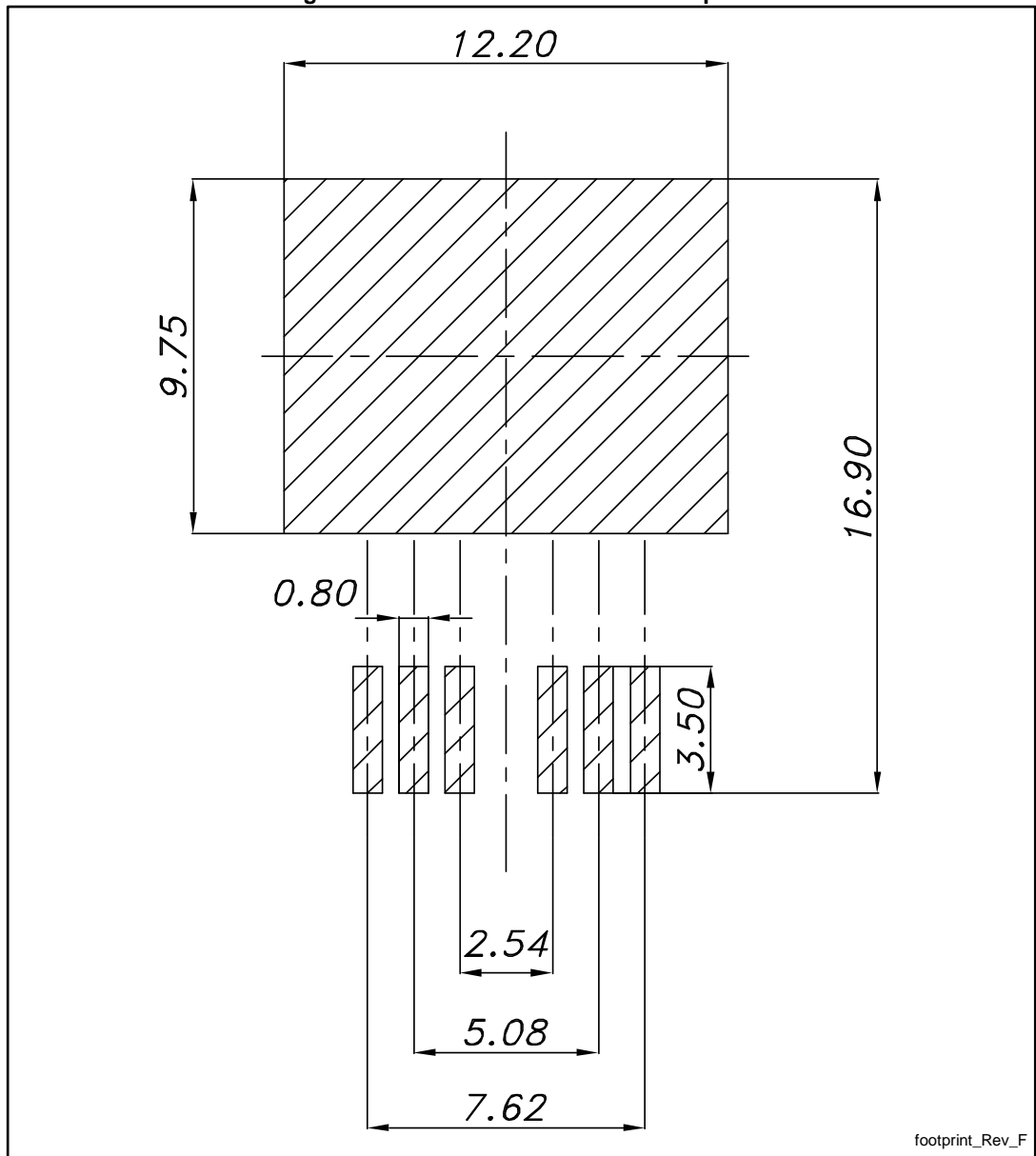


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Table 9: H²PAK-6 mechanical data

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

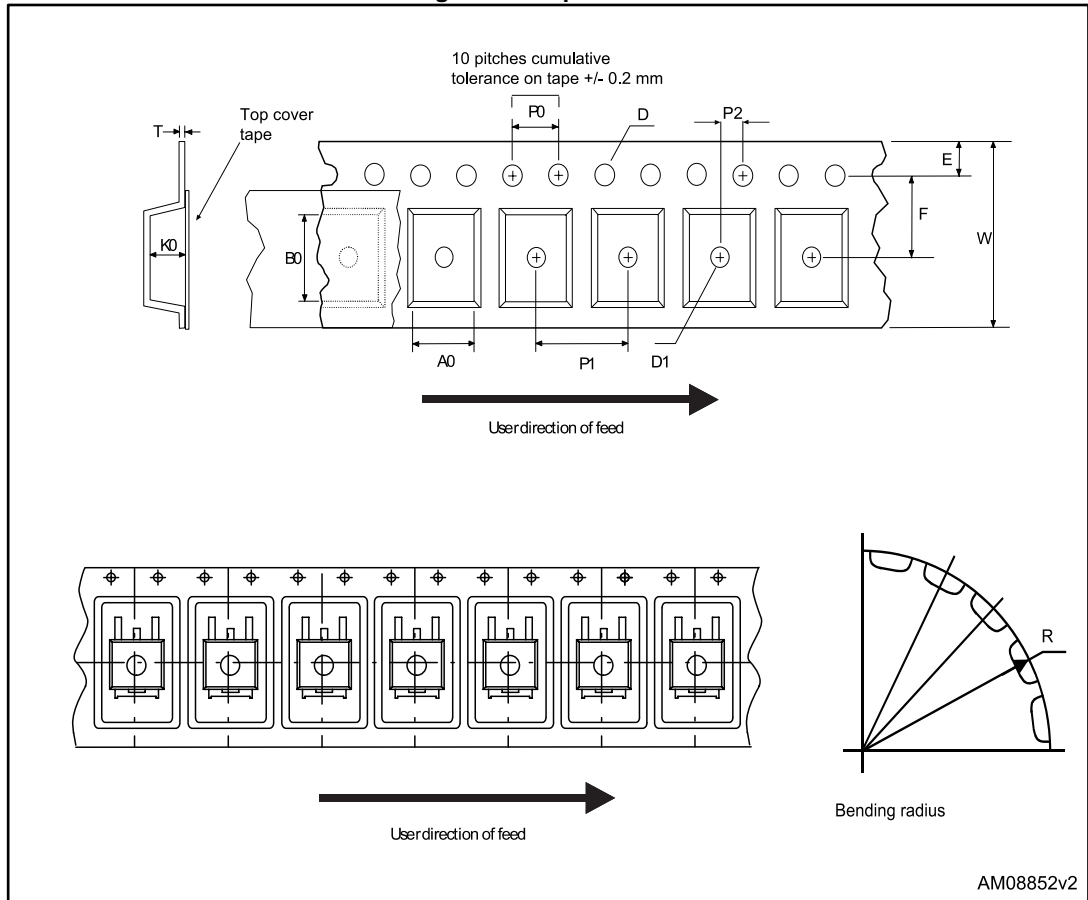


Figure 24: Reel outline

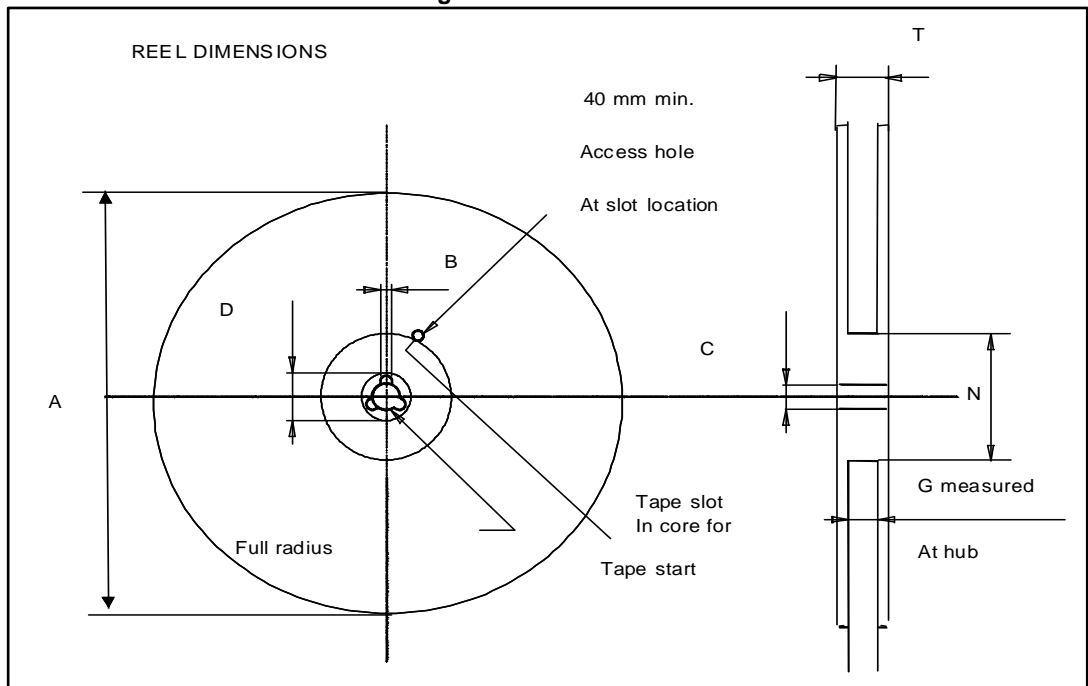


Table 10: Tape and reel mechanical data

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 (STH110N10F7-2) previously included in datasheet ID024005
16-Jul-2013	2	<ul style="list-style-type: none"> Modified: title Modified: I_{DM} value in Table 2: "Absolute maximum ratings", the entire typical values in Table 5: "Dynamic", Table 6: "Switching times" and Table 7: "Source-drain diode" Minor text changes
11-Nov-2014	3	<ul style="list-style-type: none"> Updated: H²PAK-6 package information. Updated the title, features and description. Minor text changes.
26-Nov-2014	4	Changed from Figure 2: "Safe operating area" to Figure 12: "Source-drain diode forward characteristics" .

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