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N-channel 80 V, 0.0028 Ω typ., 120 A, STripFET™ F7 Power MOSFET in a H²PAK-2 package

Datasheet — production data

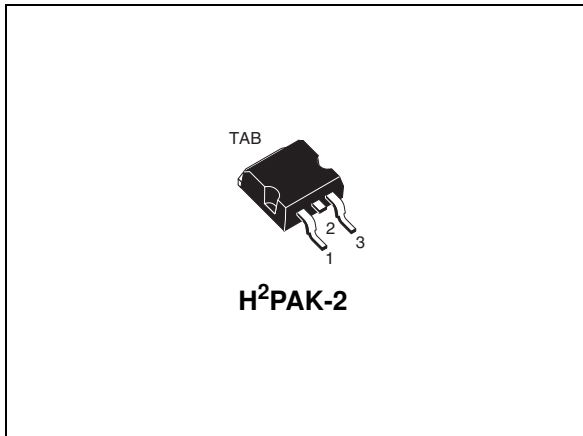
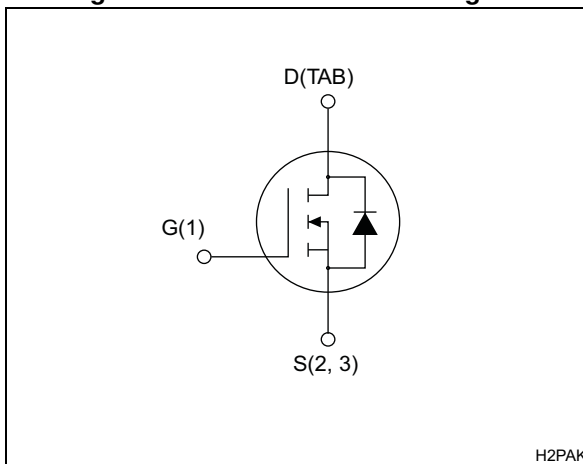


Figure 1. Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STH170N8F7-2	80 V	0.0037 Ω	120 A	250 W

- 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

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

Table 1. Device summary

Order code	Marking	Package	Packaging
STH170N8F7-2	170N8F7	H ² PAK-2	Tape and reel

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	80	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous)	120	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	120	A
I_{DM}	Drain current (pulsed)	480	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	250	W
T_J	Operating junction temperature	-55 to 175	$^\circ\text{C}$
T_{stg}	Storage temperature		$^\circ\text{C}$

1. Limited by package and rated according to R_{thj-c} .

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.6	$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	35	$^\circ\text{C/W}$

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

Table 4. Avalanche data

Symbol	Parameter	Value	Unit
I_{AV}	Not-repetitive avalanche current, (pulse width limited by T_{jmax})	35	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = I_{AV}$, $V_{DD} = 50\text{ V}$)	615	mJ

2 Electrical characteristics

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

Table 5. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 250\ \mu A$	80			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 80\text{ V}$			1	μA
		$V_{GS} = 0, V_{DS} = 80\text{ V}, T_C = 125\text{ °C}$			100	μA
I_{GSS}	Gate body leakage current	$V_{DS} = 0, V_{GS} = +20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu A$	2.5		4.5	V
$R_{DS(on)}$	Static drain-source on- resistance	$V_{GS} = 10\text{ V}, I_D = 60\text{ A}$		0.0028	0.0037	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{GS} = 0, V_{DS} = 40\text{ V}, f = 1\text{ MHz},$	-	8710	-	pF
C_{oss}	Output capacitance		-	1330	-	pF
C_{rss}	Reverse transfer capacitance		-	78	-	pF
Q_g	Total gate charge	$V_{DD} = 40\text{ V}, I_D = 120\text{ A}$	-	120	-	nC
Q_{gs}	Gate-source charge	$V_{GS} = 10\text{ V}$	-	43	-	nC
Q_{gd}	Gate-drain charge	<i>Figure 14</i>	-	26	-	nC

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 40\text{ V}, I_D = 60\text{ A}, R_G = 4.7\ \Omega, V_{GS} = 10\text{ V}$ <i>Figure 13</i>	-	38	-	ns
t_r	Rise time		-	53	-	ns
$t_{d(off)}$	Turn-off delay time		-	79	-	ns
t_f	Fall time		-	37	-	ns

Table 8. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		120	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		480	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 120 \text{ A}, V_{GS} = 0$	-		1.2	V
t_{rr}	Reverse recovery time	$I_{SD} = 120 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 64 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$	-	54		ns
Q_{rr}	Reverse recovery charge		-	78		nC
I_{RRM}	Reverse recovery current		-	2.9		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

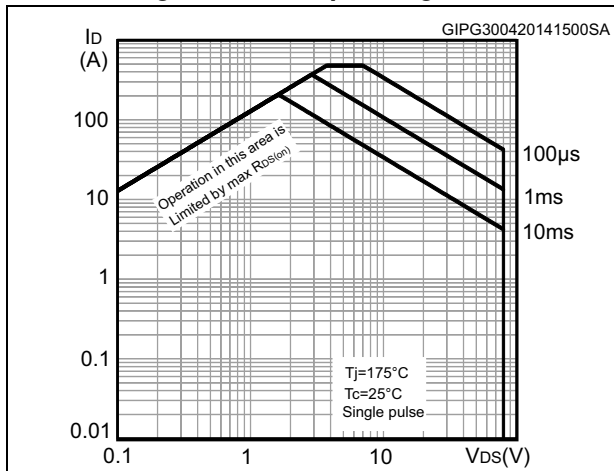


Figure 3. Thermal impedance

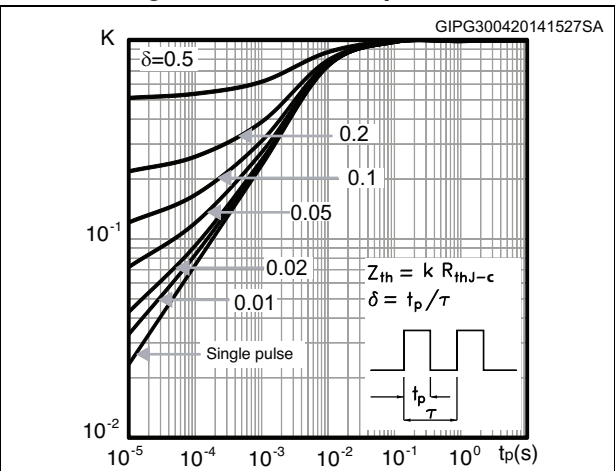


Figure 4. Output characteristics

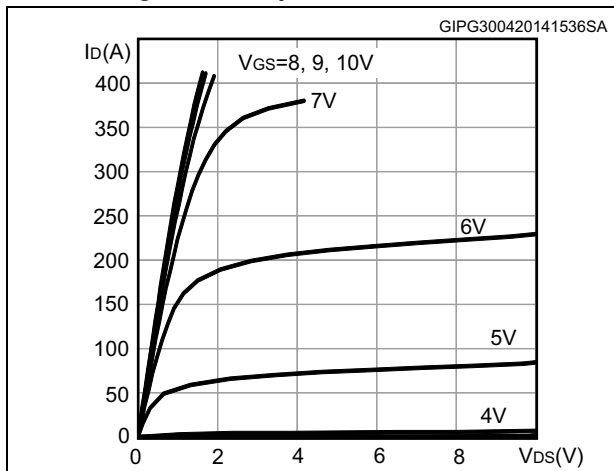


Figure 5. Transfer characteristics

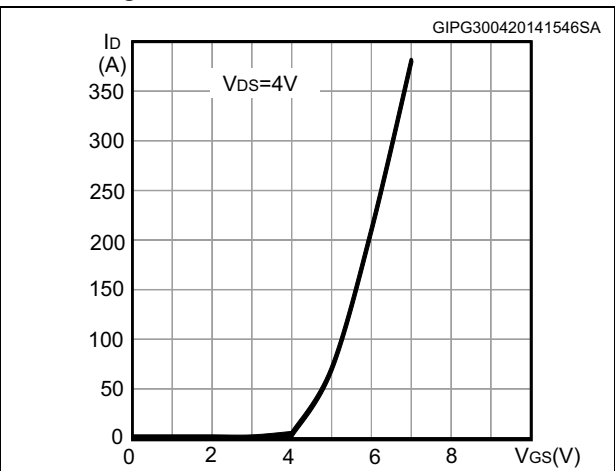


Figure 6. Gate charge vs gate-source voltage

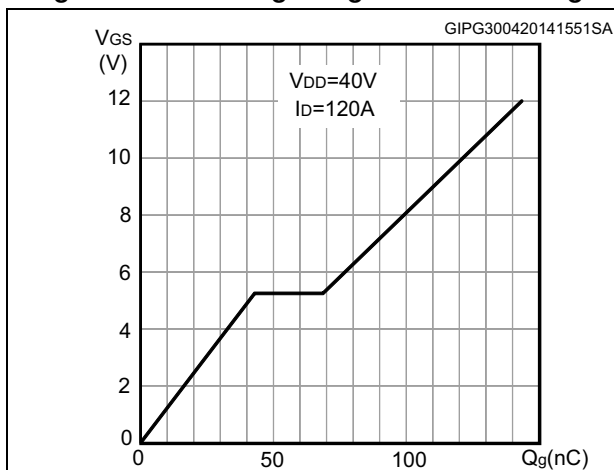


Figure 7. Static drain-source on-resistance

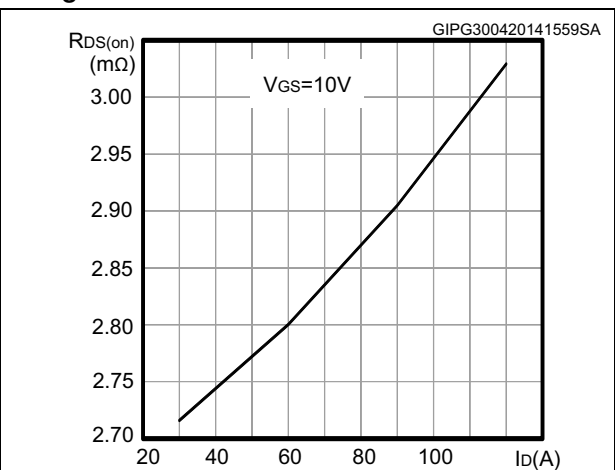


Figure 8. Capacitance variations

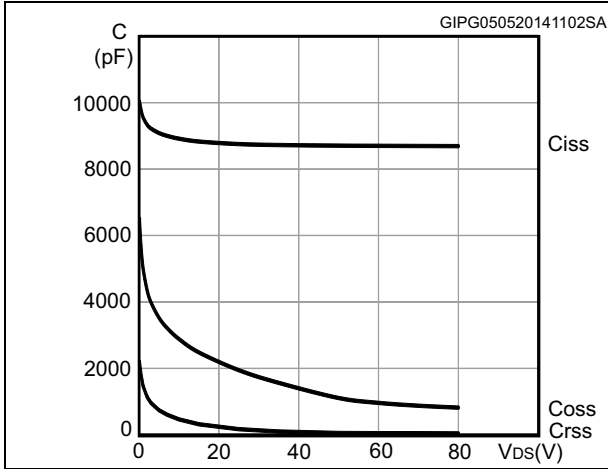


Figure 9. Normalized gate threshold voltage vs temperature

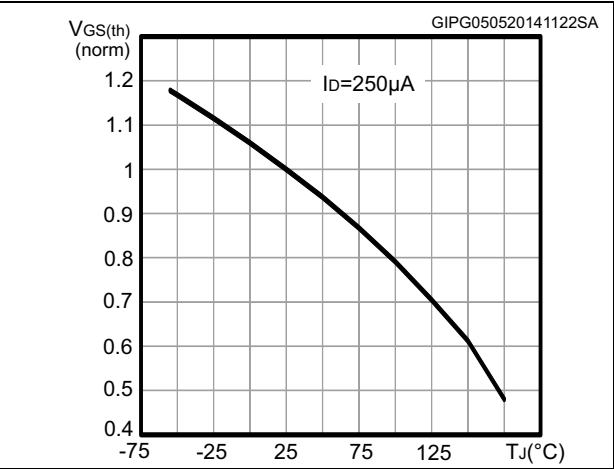


Figure 10. Normalized on-resistance vs temperature

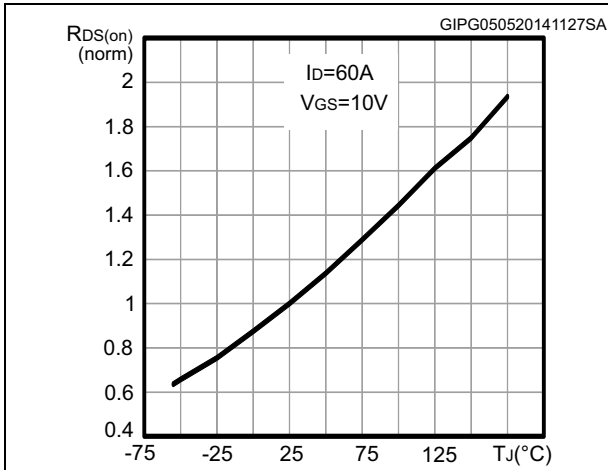


Figure 11. Normalized V(BR)DSS vs temperature

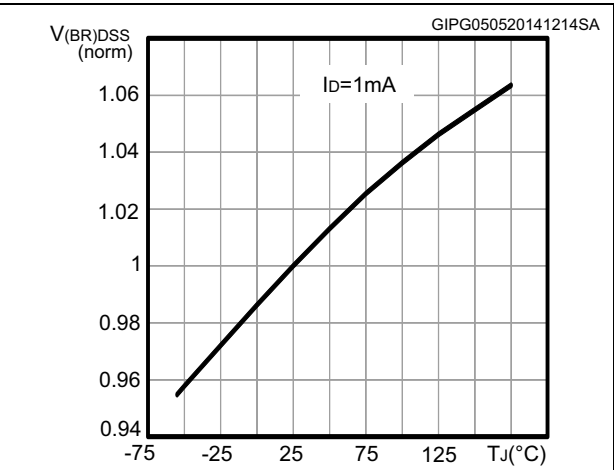
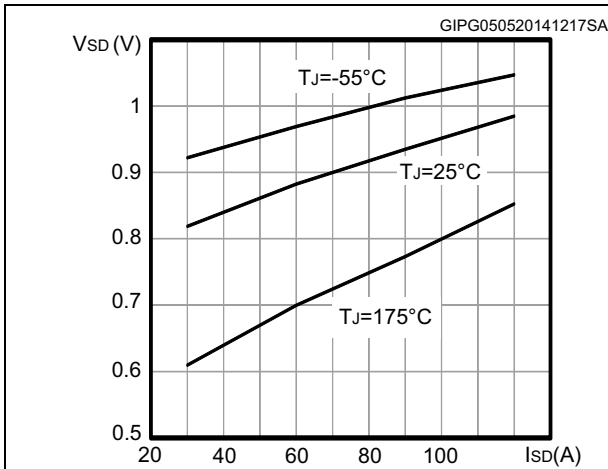
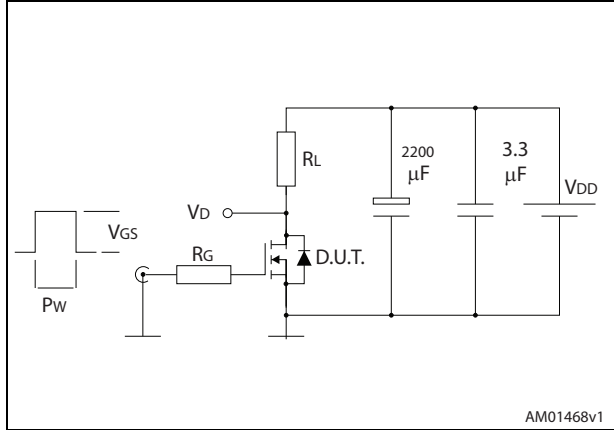


Figure 12. Source-drain diode forward characteristics



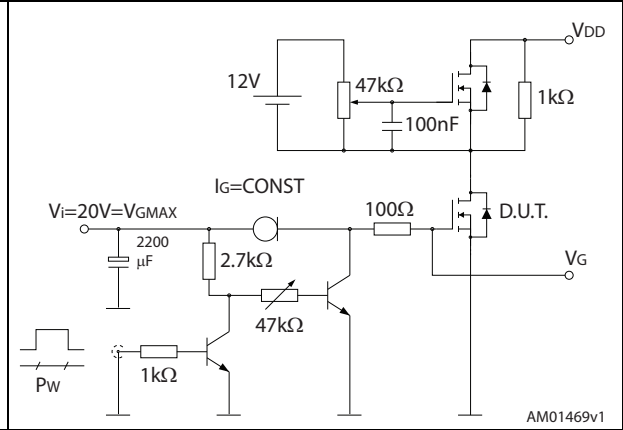
3 Test circuits

Figure 13. Switching times test circuit for resistive load



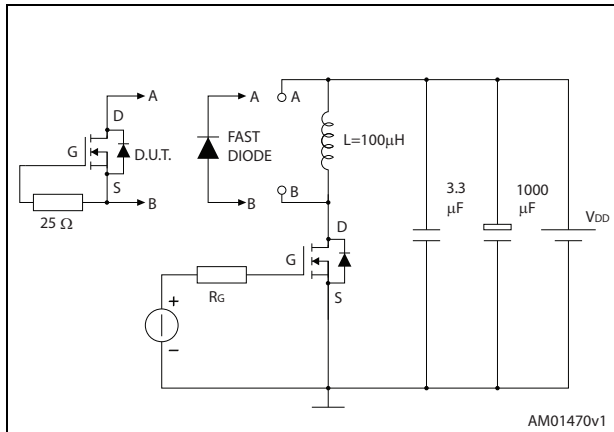
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Figure 14. Gate charge test circuit



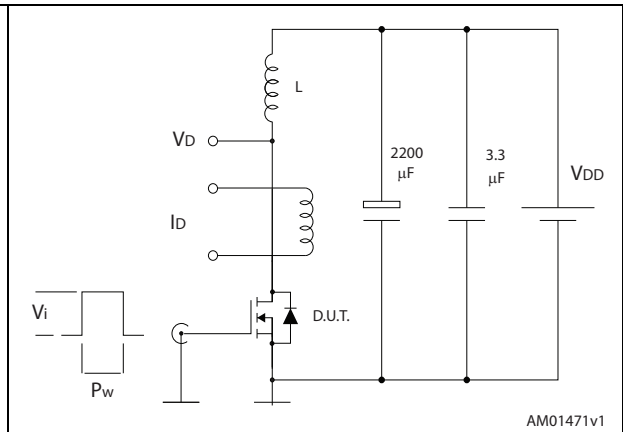
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Figure 15. Test circuit for inductive load switching and diode recovery times



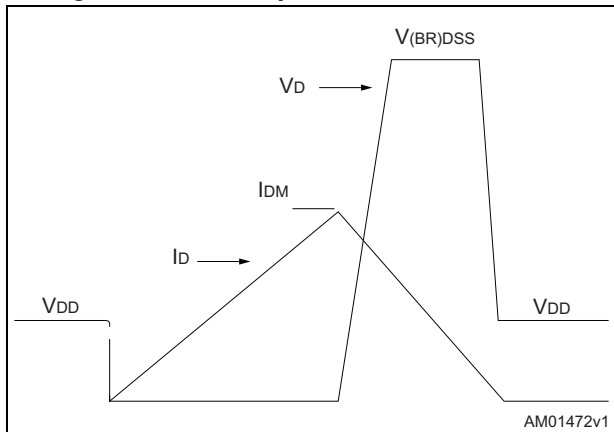
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Figure 16. Unclamped inductive load test circuit



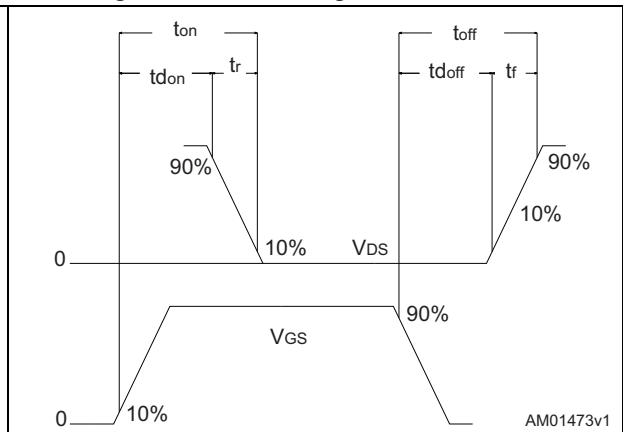
AM01471v1

Figure 17. Unclamped inductive waveform



AM01472v1

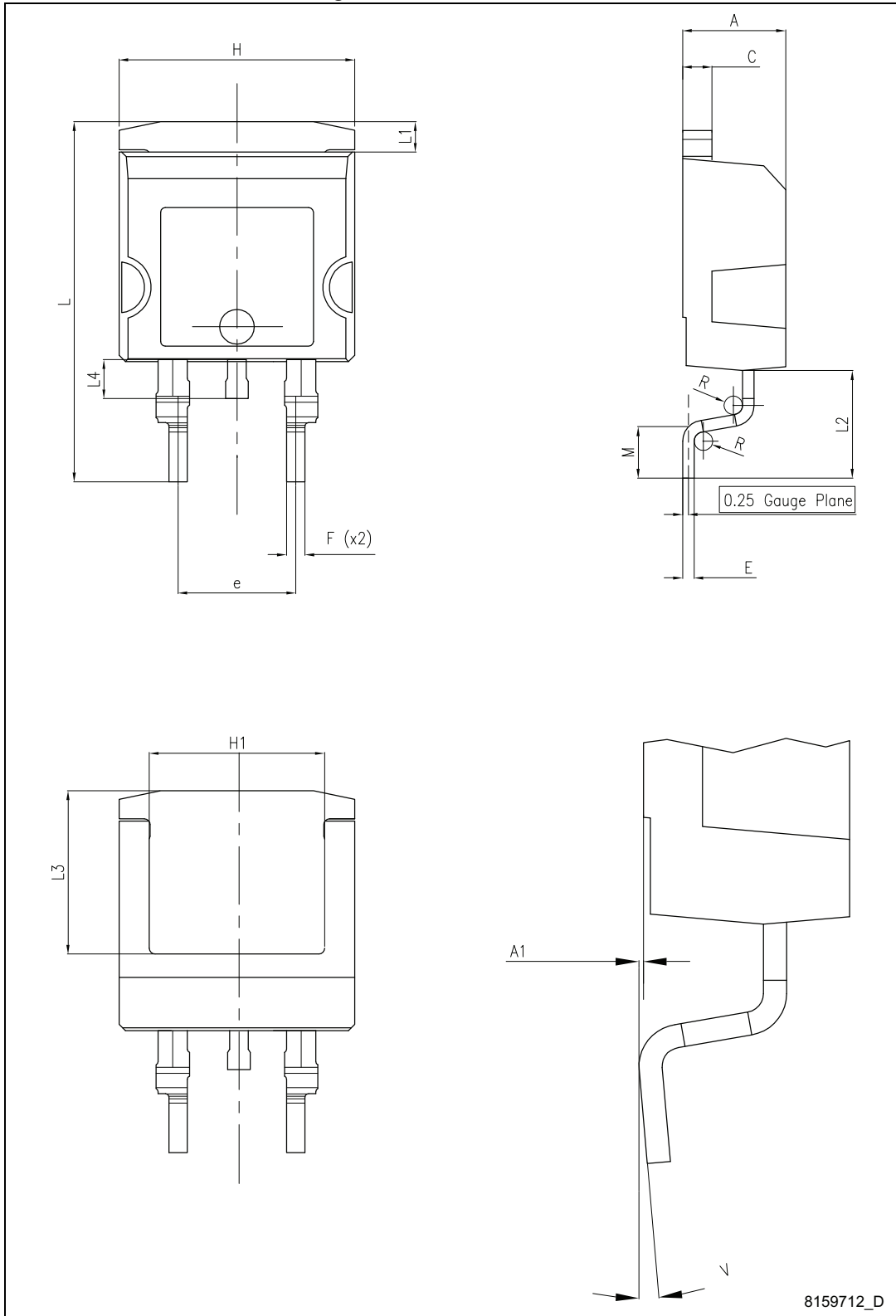
Figure 18. Switching time waveform



AM01473v1

4 Package information

Figure 19. H²PAK-2 outline



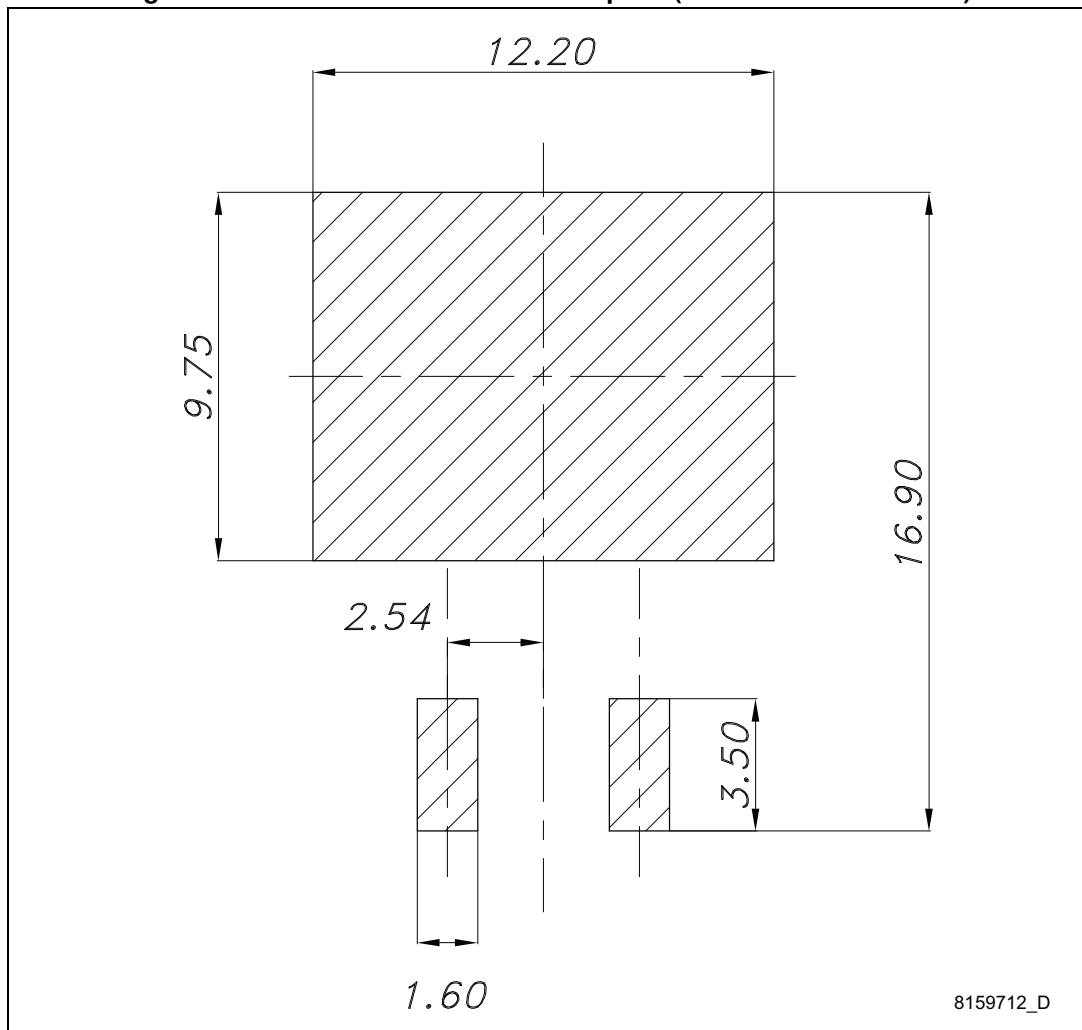
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Table 9. H²PAK-2 mechanical data

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 (dimensions are in mm)



5 Packing information

Figure 21. Tape

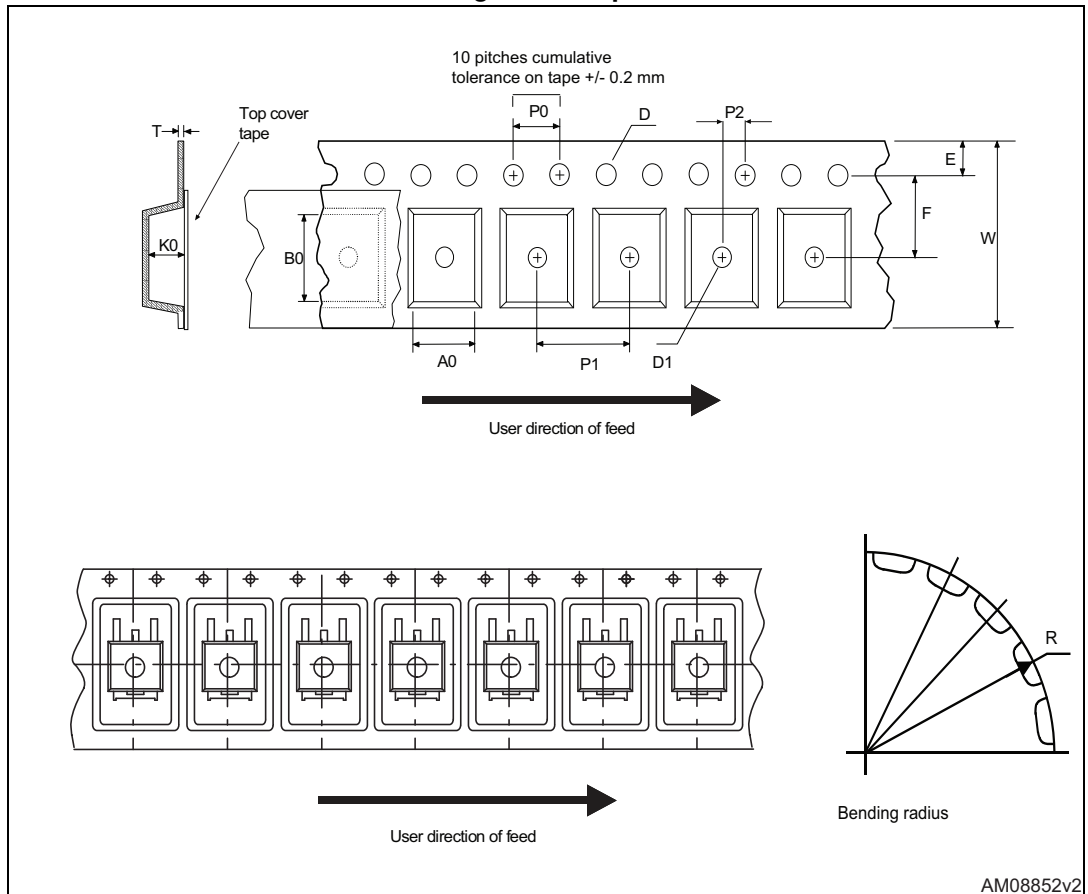


Figure 22. Reel

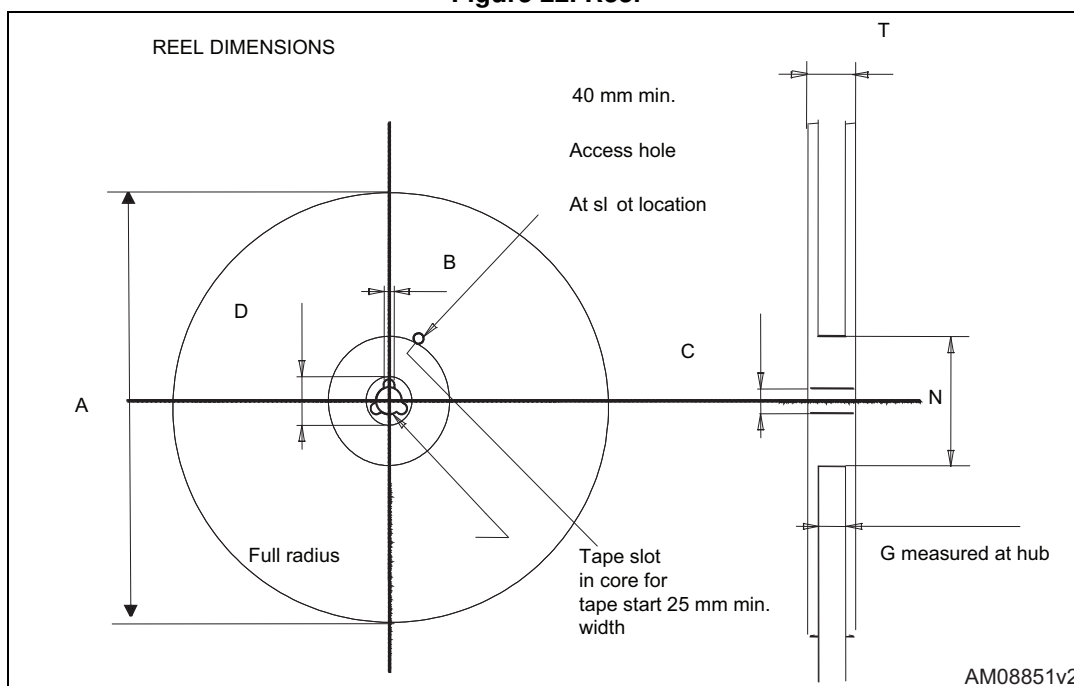


Table 10. H²PAK-2 tape and reel mechanical data

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 11. Document revision history

Date	Revision	Changes
20-May-2014	1	First release.
20-Feb-2015	2	Document status promoted from preliminary to production data. Updated Section 4: Package information . Updated title, features and description in cover page.

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