



**THE DATASHEET OF  
STH160N4LF6-2**



## N-channel 40 V, 0.0018 mΩ typ., 120 A, STripFET™ VI DeepGATE™ Power MOSFET in a H<sup>2</sup>PAK-2 package

Datasheet - production data

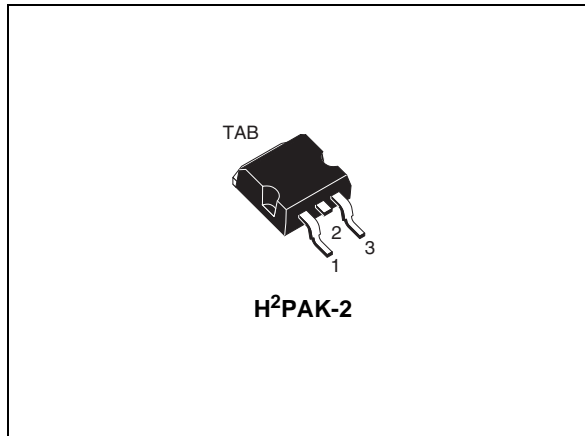
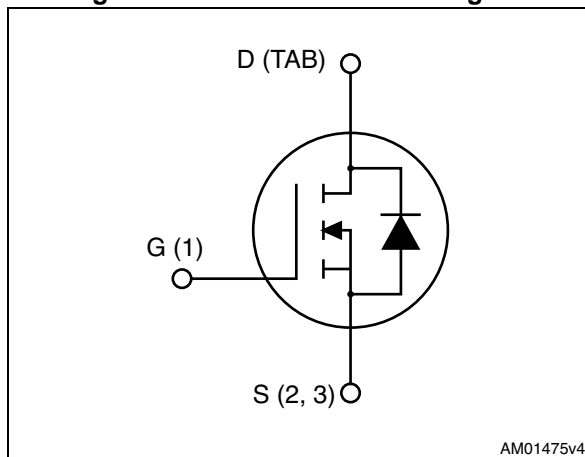


Figure 1. Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>	P <sub>TOT</sub>
STH160N4LF6-2	40 V	0.0022 Ω	120 A	150 W

- R<sub>DS(on)</sub> \* Q<sub>g</sub> industry benchmark
- Extremely low on-resistance R<sub>DS(on)</sub>
- Logic level drive
- High avalanche ruggedness
- 100% avalanche tested

### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using the 6<sup>th</sup> generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R<sub>DS(on)</sub> in all packages.

Table 1. Device summary

Order code	Marking	Package	Packaging
STH160N4LF6-2	160N4LF6	H <sup>2</sup> PAK-2	Tape and reel

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	40	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	120	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	100	A
$I_{DM}^{(1)}$	Drain current (pulsed)	480	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	150	W
	Derating factor	1	W/ $^\circ\text{C}$
$I_{AS}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_{jmax}$ )	60	A
$E_{AS}$	Single pulse avalanche energy	323	mJ
$T_{stg}$	Storage temperature	-55 to 175	$^\circ\text{C}$
$T_j$	Operating junction temperature		

1. Pulse width is limited by safe operating area

**Table 3. Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.0	$^\circ\text{C}/\text{W}$
$R_{thj-a}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$

## 2 Electrical characteristics

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

**Table 4. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ( $V_{GS} = 0$ )	$I_D = 250\ \mu A$	40	-		V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 20\text{ V}$		-	1	$\mu A$
		$V_{DS} = 20\text{ V}, T_C = 125\text{ °C}$			10	$\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$		-	$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu A$	1	-		V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 60\text{ A}$		0.0018	0.0022	$\Omega$
		$V_{GS} = 5\text{ V}, I_D = 60\text{ A}$		0.002	0.0027	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
$C_{ISS}$	Input capacitance	$V_{DS} = 20\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$	-	8130	-	pF
$C_{OSS}$	Output capacitance		-	770	-	pF
$C_{RSS}$	Reverse transfer capacitance		-	670	-	pF
$Q_g$	Total gate charge	$V_{DD} = 20\text{ V}, I_D = 60\text{ A}$	-	181	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10\text{ V}$	-	22	-	nC
$Q_{gd}$	Gate-drain charge	(see <a href="#">Figure 14</a> )	-	46	-	nC

**Table 6. Switching on/off (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20\text{ V}, I_D = 60\text{ A}, R_G = 4.7\ \Omega, V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15</a> )	-	20	-	ns
$t_r$	Rise time		-	131	-	ns
$t_{d(off)}$	Turn-off delay time		-	205	-	ns
$t_f$	Fall time		-	116	-	ns

Table 7. 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	$I_{SD} = 120 \text{ A}$ , $V_{GS} = 0$	-		0.97	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 120 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 32 \text{ V}$ (see <a href="#">Figure 17</a> )	-	57		ns
$Q_{rr}$	Reverse recovery charge		-	53		nC
$I_{RRM}$	Reverse recovery current		-	1.86		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

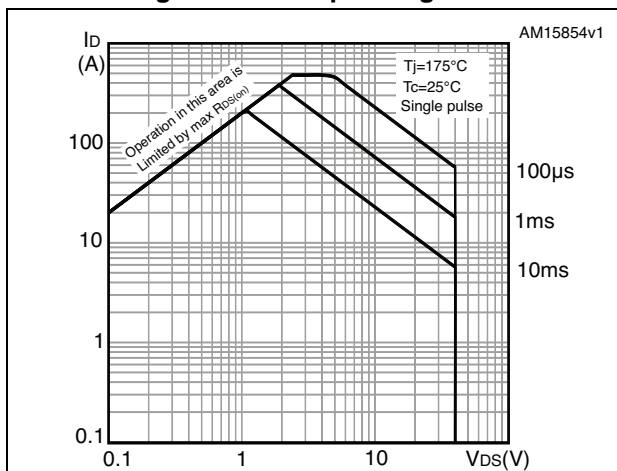


Figure 3. Thermal impedance

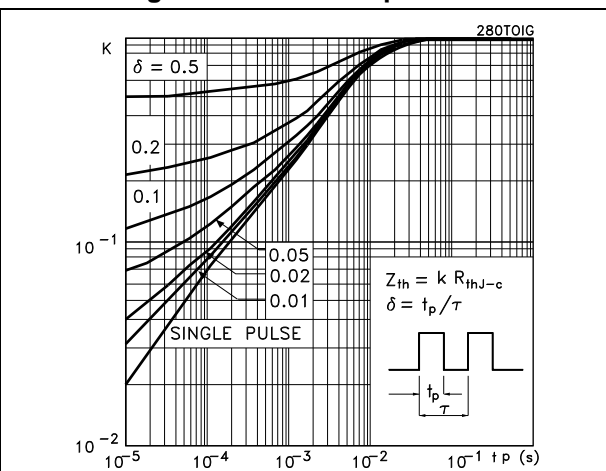


Figure 4. Output characteristics

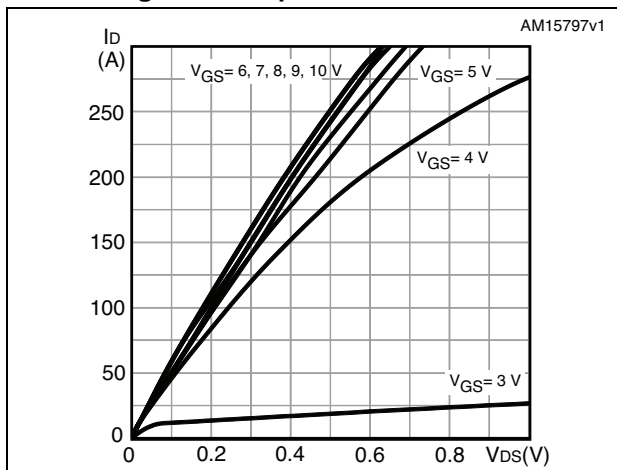


Figure 5. Transfer characteristics

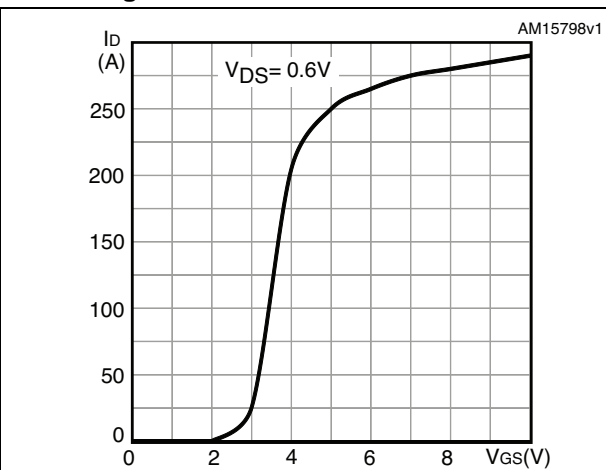


Figure 6. Gate charge vs gate-source voltage

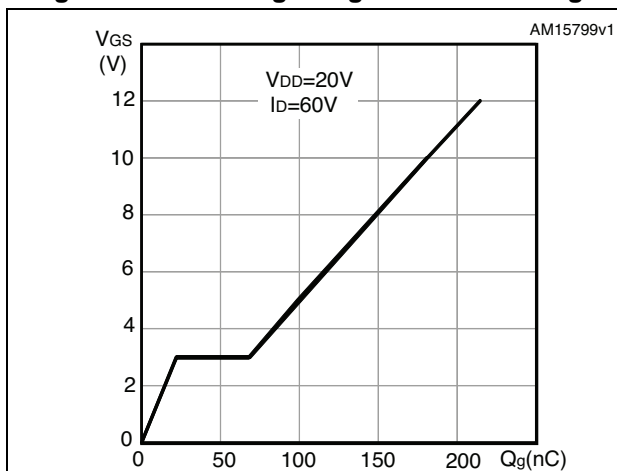


Figure 7. Static drain-source on-resistance

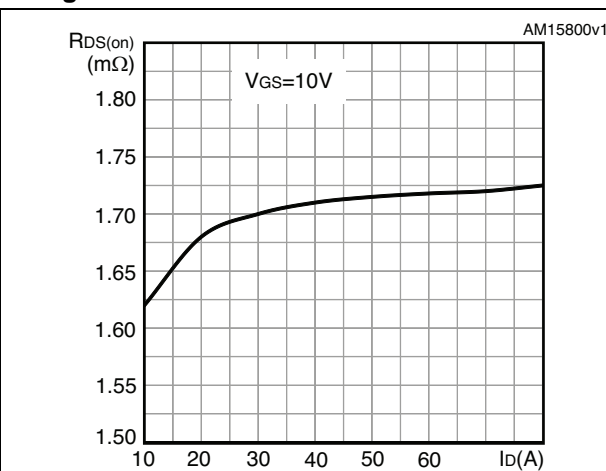


Figure 8. Capacitance variations

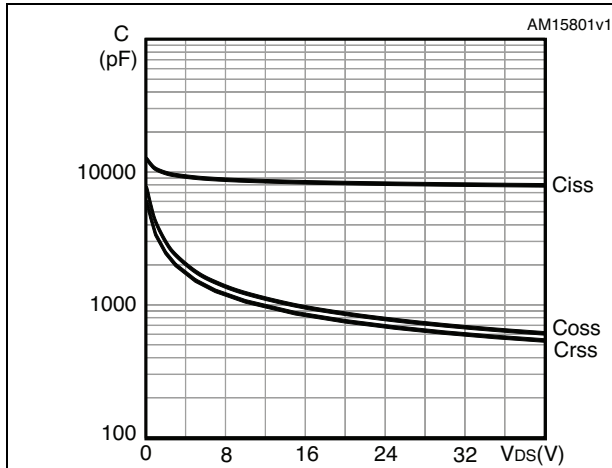


Figure 9. Normalized  $V_{(BR)DSS}$  vs temperature

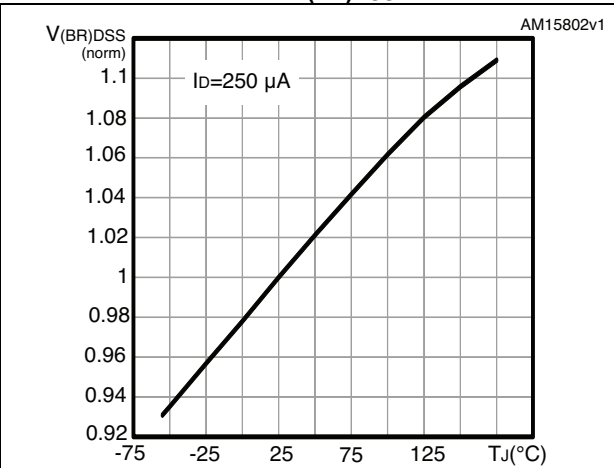


Figure 10. Normalized gate threshold voltage vs temperature

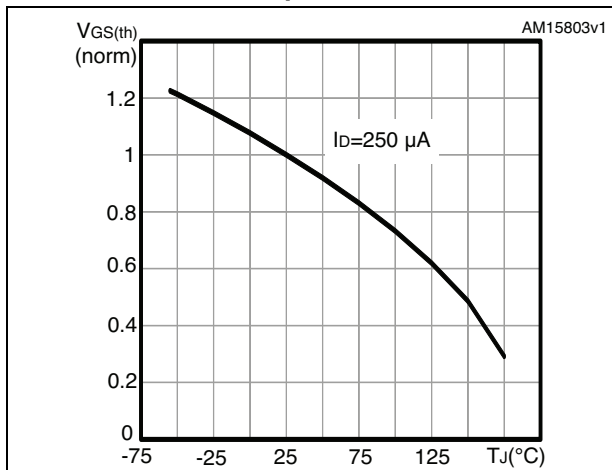


Figure 11. Normalized on-resistance vs temperature

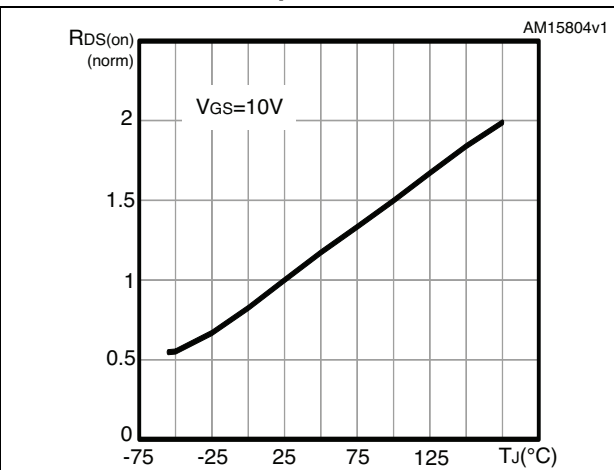
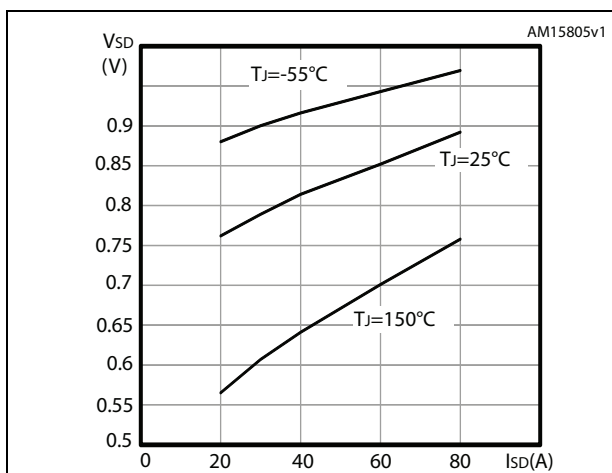
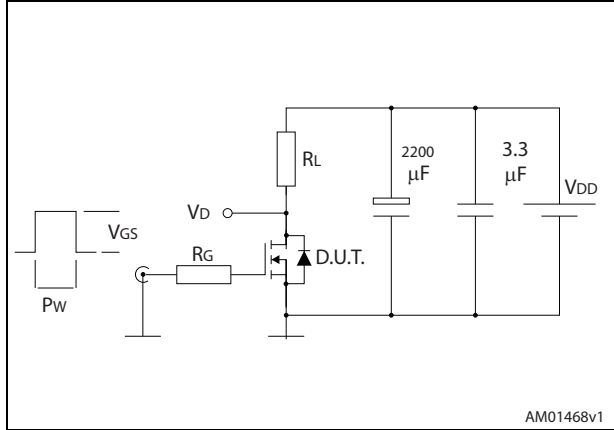


Figure 12. Source-drain diode forward characteristics



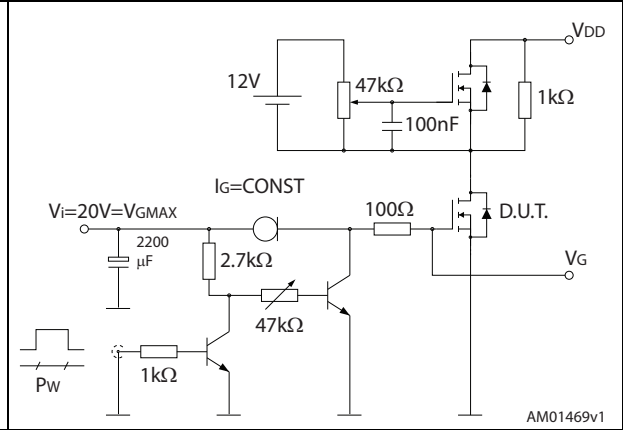
### 3 Test circuits

Figure 13. Switching times test circuit for resistive load



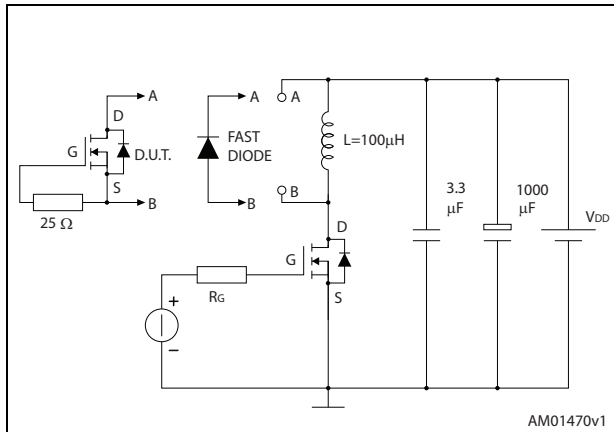
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Figure 14. Gate charge test circuit



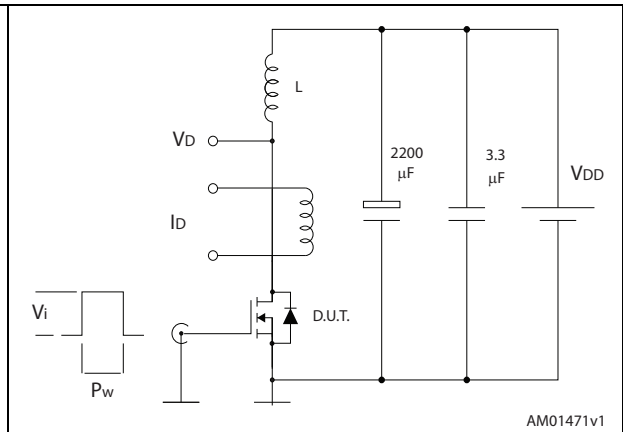
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Figure 15. Test circuit for inductive load switching and diode recovery times



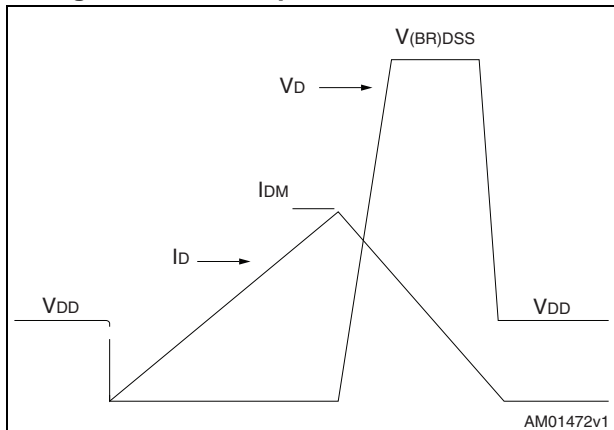
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Figure 16. Unclamped inductive load test circuit



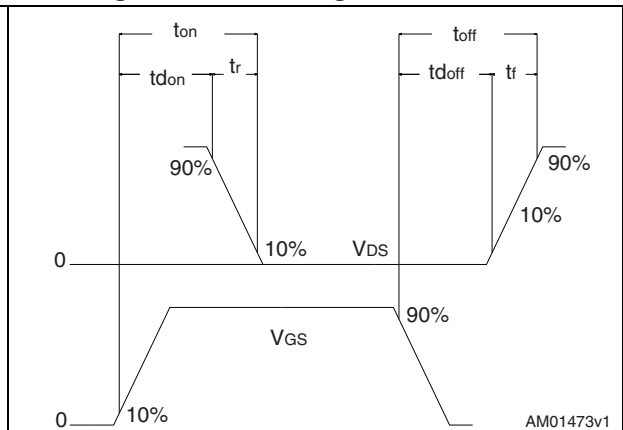
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Figure 17. Unclamped inductive waveform



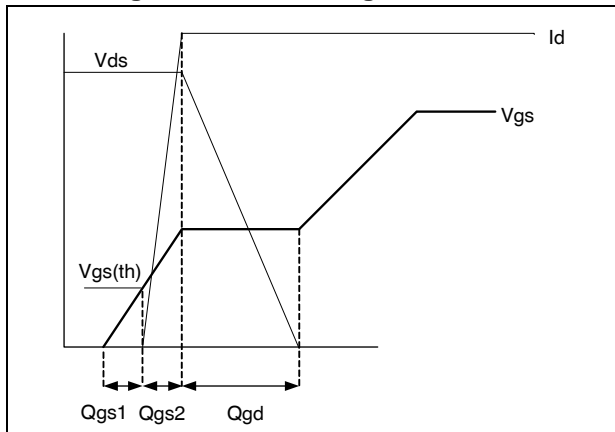
AM01472v1

Figure 18. Switching time waveform



AM01473v1

Figure 19. Gate charge waveform



## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

Figure 20. H<sup>2</sup>PAK-2 drawing

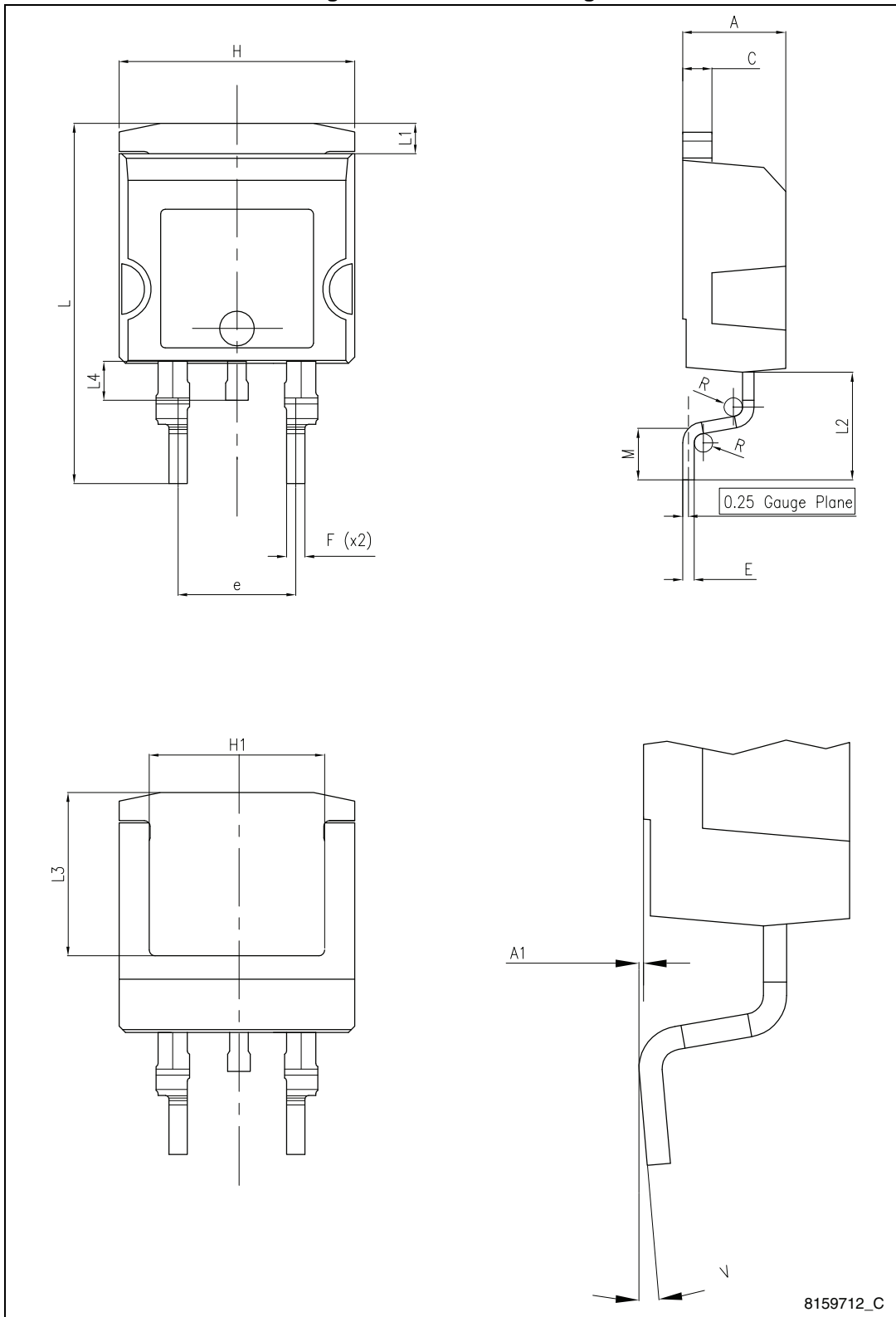
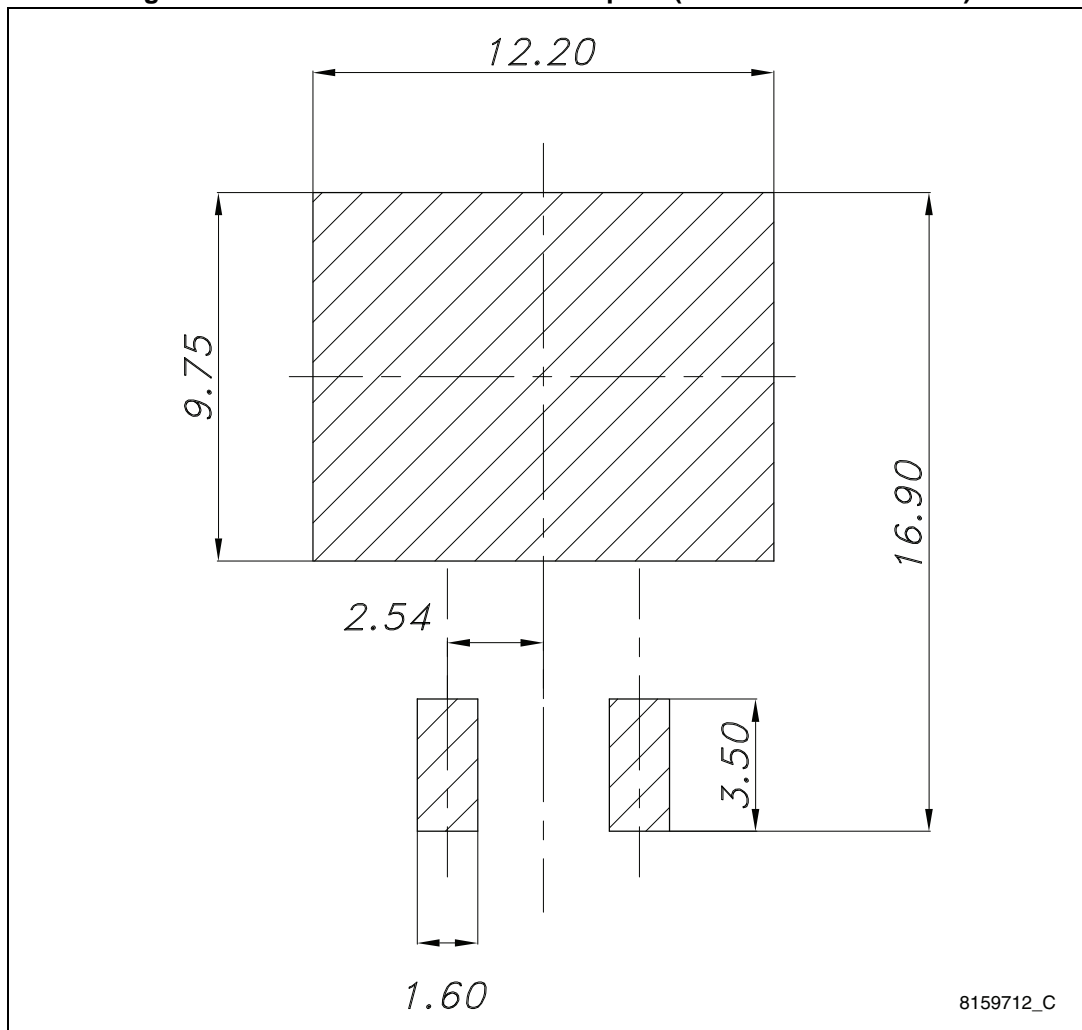


Table 8. H<sup>2</sup>PAK-2 mechanical data

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 21. H<sup>2</sup>PAK-2 recommended footprint (dimensions are in mm)



8159712\_C

# 5 Packaging mechanical data

Figure 22. Tape

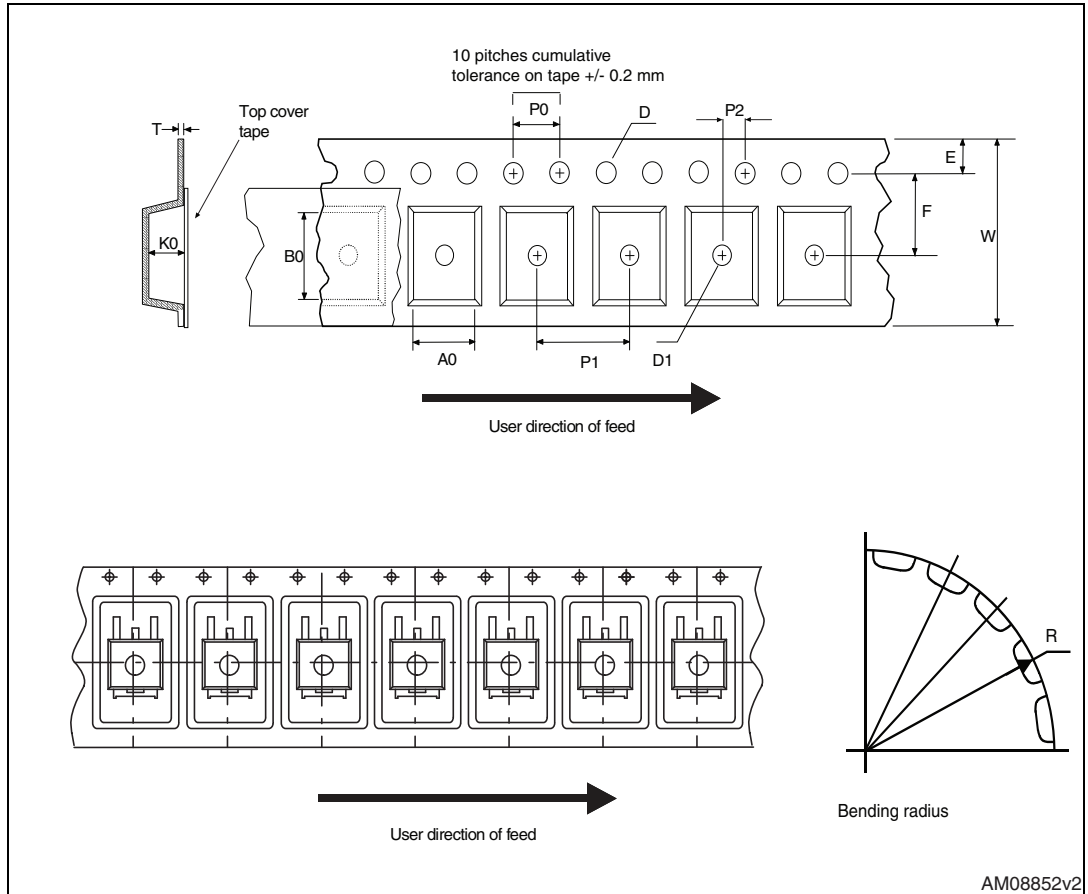


Figure 23. Reel

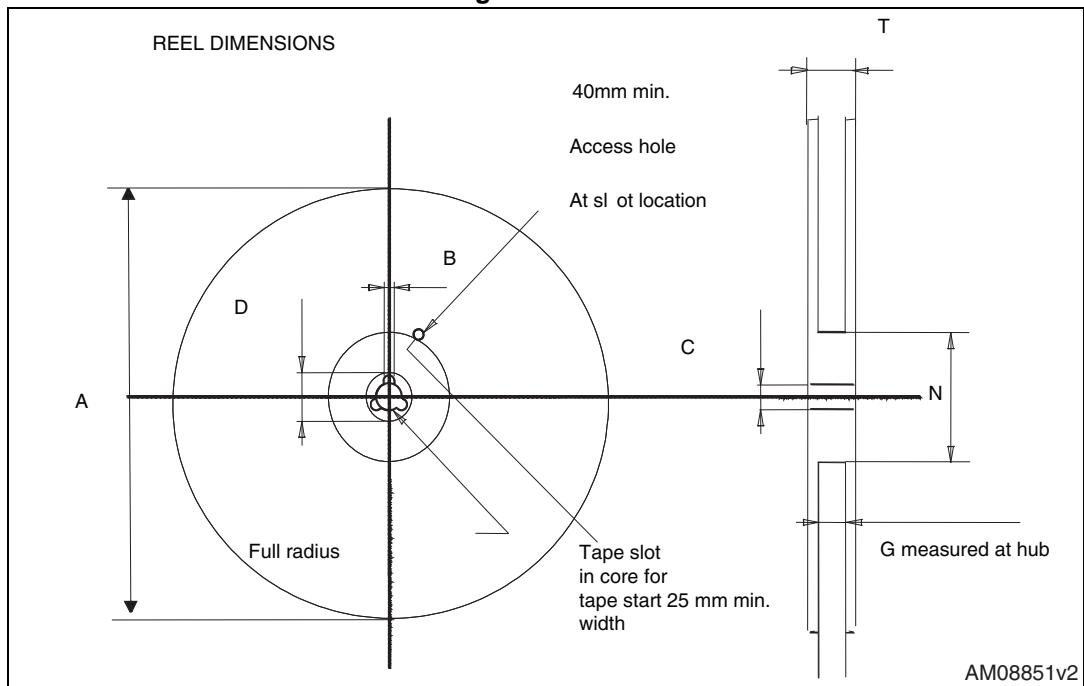


Table 9. H<sup>2</sup>PAK-2 leads tape and reel mechanical data

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 10. Document revision history

Date	Revision	Changes
24-Apr-2014	1	First release.

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