

N-channel 80 V, 0.0017  $\Omega$  typ., 180 A, STripFET™ F7  
Power MOSFETs in H<sup>2</sup>PAK-2, H<sup>2</sup>PAK-6 and TO-220 packages

Datasheet – production data

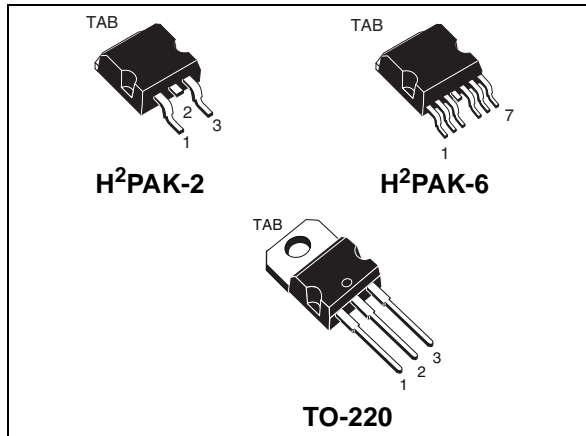
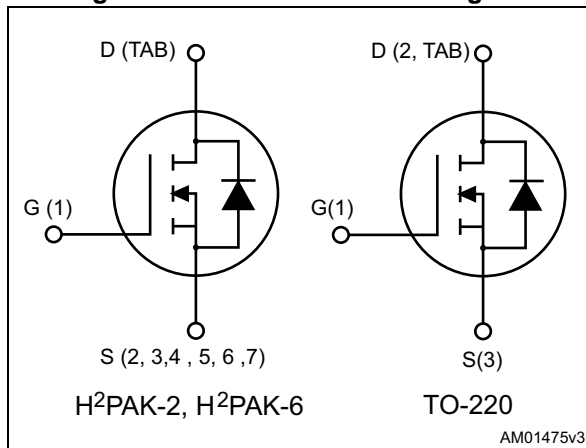


Figure 1. Internal schematic diagram



## Features

Order codes	V <sub>DS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STH270N8F7-2	80 V	0.0021 $\Omega$	180 A
STH270N8F7-6			
STP270N8F7		0.0025 $\Omega$	

- Among the lowest R<sub>DS(on)</sub> on the market
- Excellent figure of merit (FoM)
- Low C<sub>rss</sub>/C<sub>iss</sub> 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-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STH270N8F7-2	270N8F7	H <sup>2</sup> PAK-2	Tape and reel
STH270N8F7-6		H <sup>2</sup> PAK-6	
STP270N8F7		TO-220	Tube

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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	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous)	180	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	180	A
$I_{DM}^{(2)}$	Drain current (pulsed)	720	A
$P_{TOT}^{(3)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	315	W
$E_{AS}^{(4)}$	Single pulse avalanche energy	1.16	J
$T_J$	Operating junction temperature	-55 to 175	$^\circ\text{C}$
$T_{stg}$	Storage temperature		$^\circ\text{C}$

1. Limited by package
2. Pulse width limited by safe operating area
3. This value is rated according to  $R_{thj-c}$
4. Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_d = 65\text{ A}$ ,  $V_{dd} = 50\text{ V}$

**Table 3. Thermal resistance**

Symbol	Parameter	Value		Unit
		H <sup>2</sup> PAK-2, H <sup>2</sup> PAK-6	TO-220	
$R_{thj-case}$	Thermal resistance junction-case	0.48		$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	35		$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max		62.5	$^\circ\text{C}/\text{W}$

1. When mounted on FR-4 board of 1 inch<sup>2</sup>, 2oz Cu

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ( $V_{GS}=0$ )	$I_D = 250\ \mu\text{A}$	80			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS}=0$ )	$V_{DS} = 80\text{ V}$ $V_{DS} = 80\text{ V}; T_C=125\text{ °C}$			10 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS}=0$ )	$V_{GS} = +20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS}=V_{GS}, I_D = 250\ \mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	For H <sup>2</sup> PAK-2, H <sup>2</sup> PAK-6: $V_{GS} = 10\text{ V}, I_D = 90\text{ A}$		0.0017	0.0021	$\Omega$
		For TO-220: $V_{GS} = 10\text{ V}, I_D = 90\text{ A}$		0.0021	0.0025	

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS}=50\text{ V}, f=1\text{ MHz},$ $V_{GS}=0$	-	13600	-	pF
$C_{oss}$	Output capacitance		-	2050	-	pF
$C_{rss}$	Reverse transfer capacitance		-	236	-	pF
$Q_g$	Total gate charge	$V_{DD}=40\text{ V}, I_D = 180\text{ A}$ $V_{GS} = 10\text{ V}$ <i>Figure 19</i>	-	193	-	nC
$Q_{gs}$	Gate-source charge		-	96	-	nC
$Q_{gd}$	Gate-drain charge		-	46	-	nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD}=40\text{ V}, I_D = 90\text{ A},$ $R_G=4.7\ \Omega, V_{GS} = 10\text{ V}$ <i>Figure 18</i>	-	56	-	ns
$t_r$	Rise time		-	180	-	ns
$t_{d(off)}$	Turn-off delay time		-	98	-	ns
$t_f$	Fall time		-	42	-	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	$I_{SD} = 90 \text{ A}, V_{GS} = 0$	-		1.2	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 180 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 64 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$	-	78		ns
$Q_{rr}$	Reverse recovery charge		-	182		nC
$I_{RRM}$	Reverse recovery current		-	4.7		A

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

### 3 Electrical characteristics (curves)

Figure 2. Safe operating area for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6

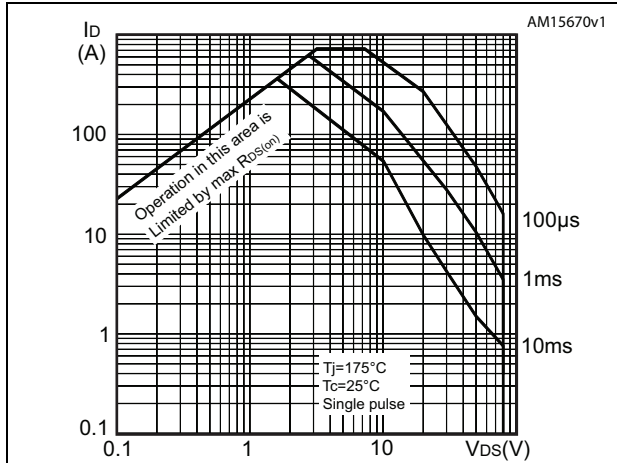


Figure 3. Safe operating area for TO-220

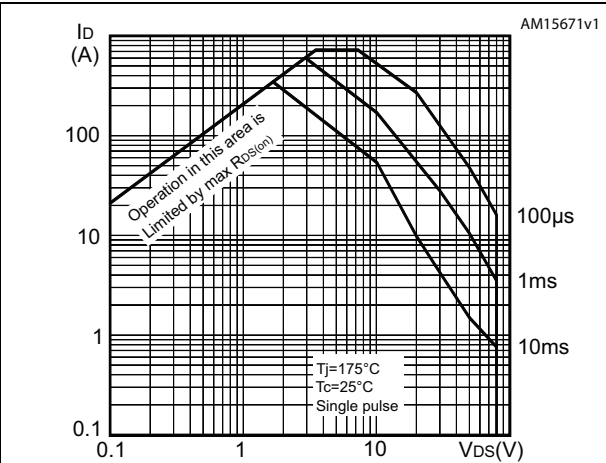


Figure 4. Thermal impedance

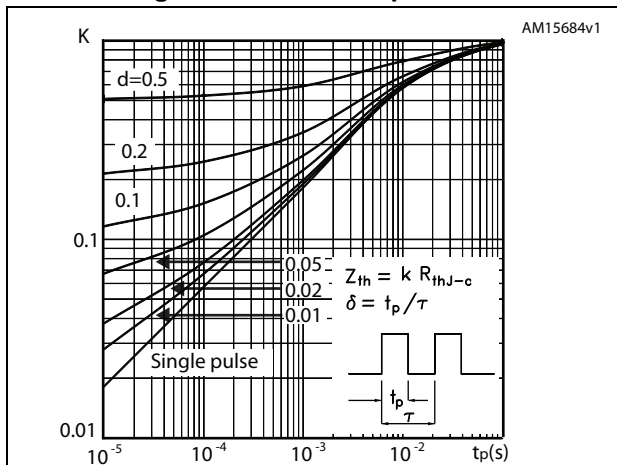


Figure 5. Gate charge vs gate-source voltage

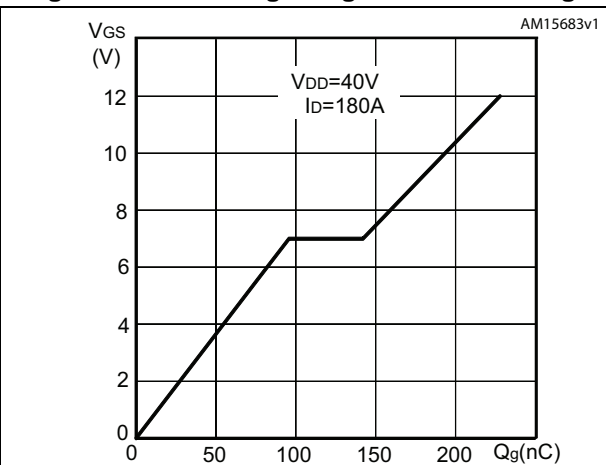


Figure 6. Output characteristics for TO-220

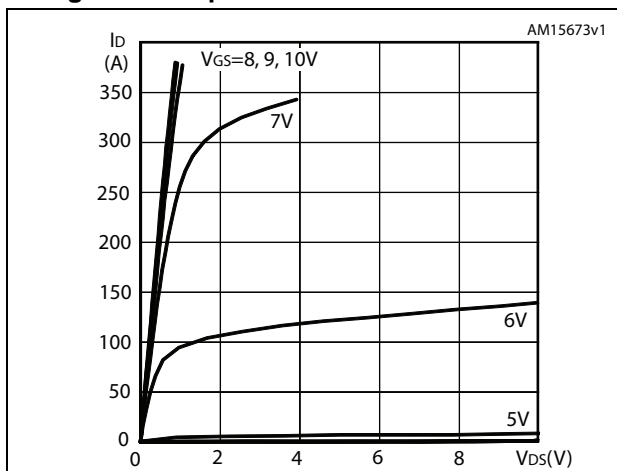


Figure 7. Transfer characteristics for TO-220

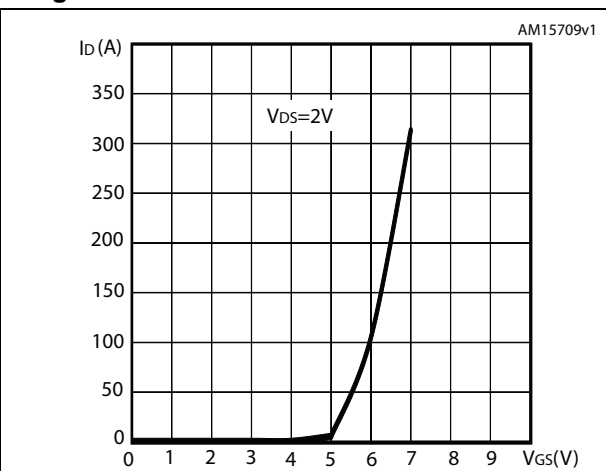


Figure 8. Output characteristics for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6

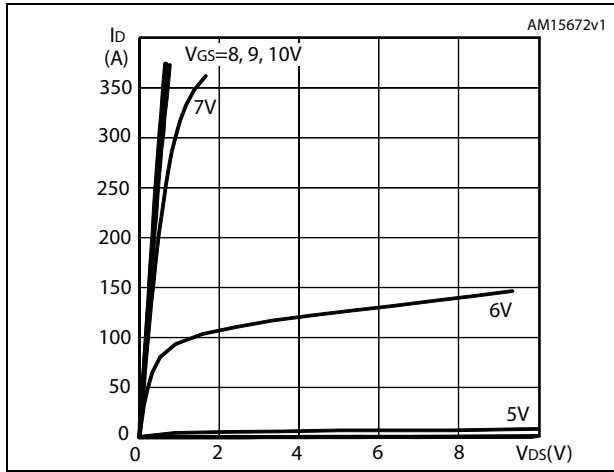


Figure 9. Transfer characteristics for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6

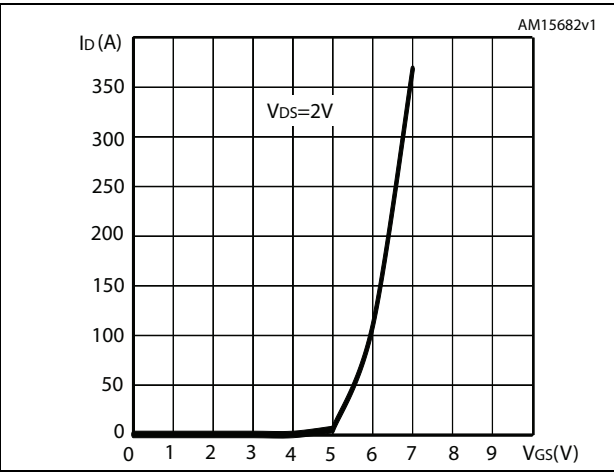


Figure 10. Normalized V<sub>(BR)DSS</sub> vs temperature

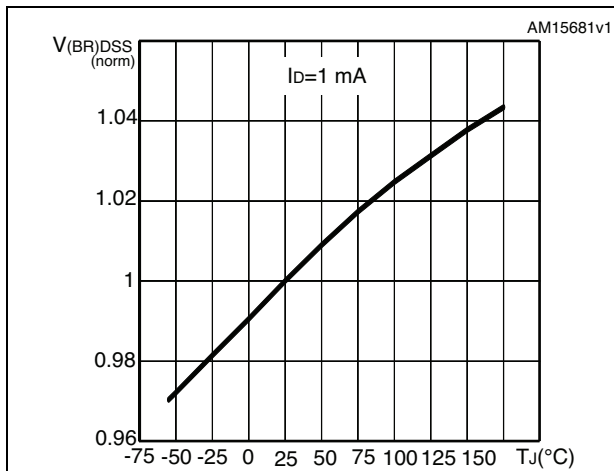


Figure 11. Static drain-source on-resistance for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6

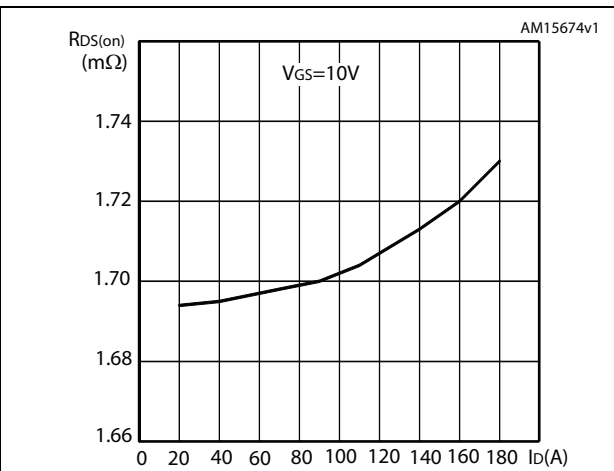


Figure 12. Static drain-source on-resistance for TO-220

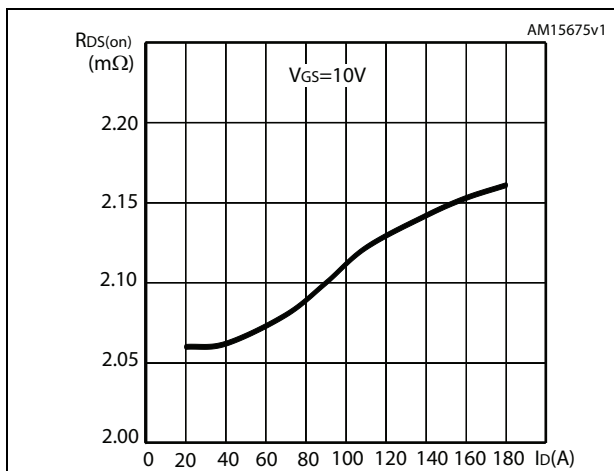


Figure 13. Capacitance variations

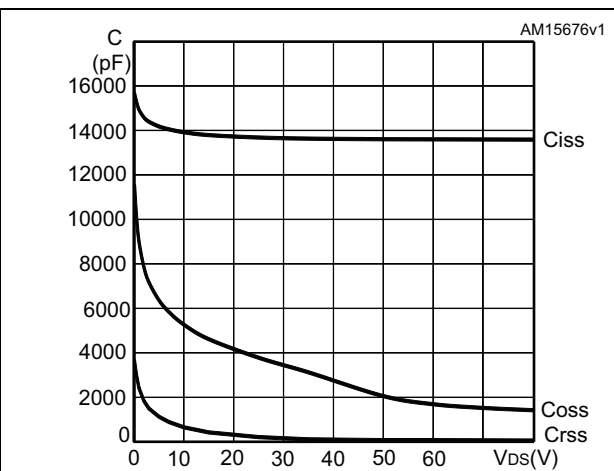


Figure 14. Source-drain diode forward characteristics

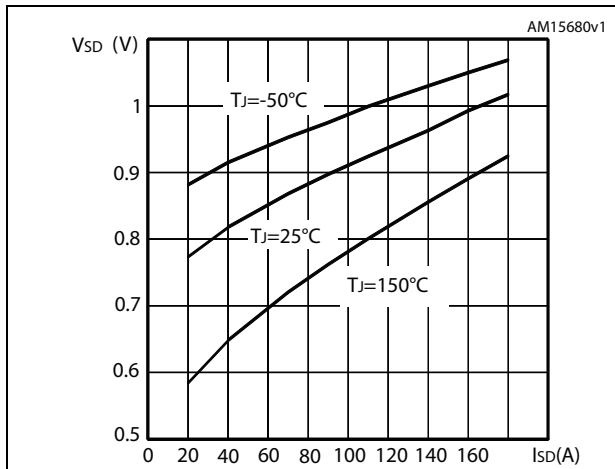


Figure 15. Normalized gate threshold voltage vs temperature

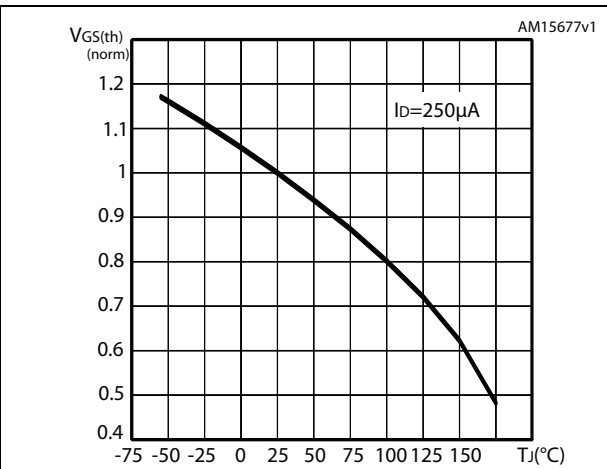


Figure 16. Normalized on-resistance vs temperature for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6

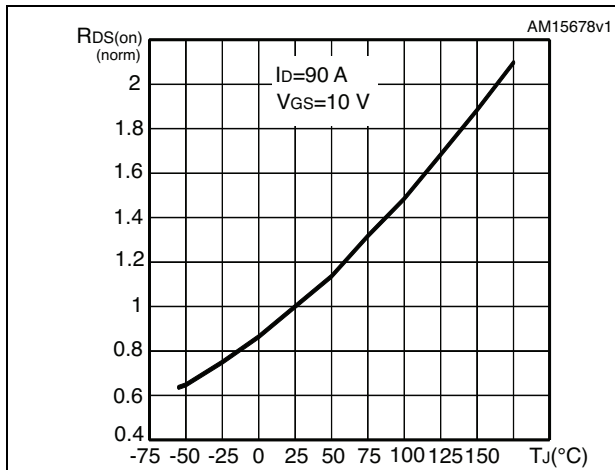
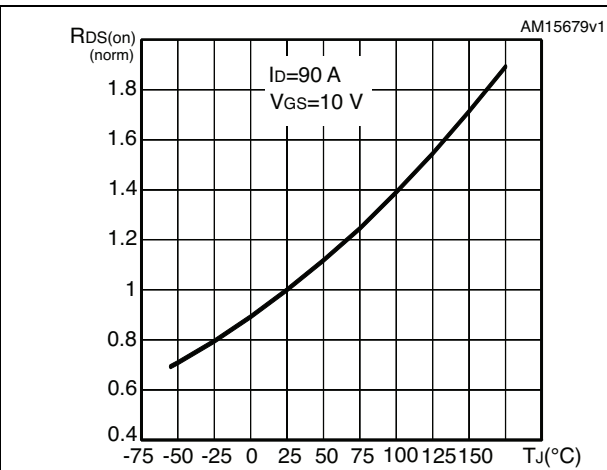


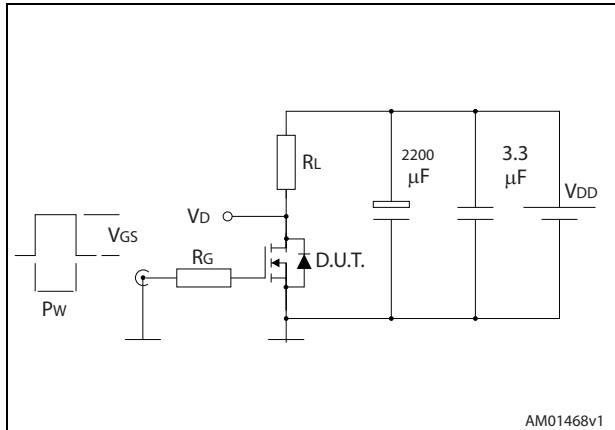
Figure 17. Normalized on-resistance vs temperature for TO-220



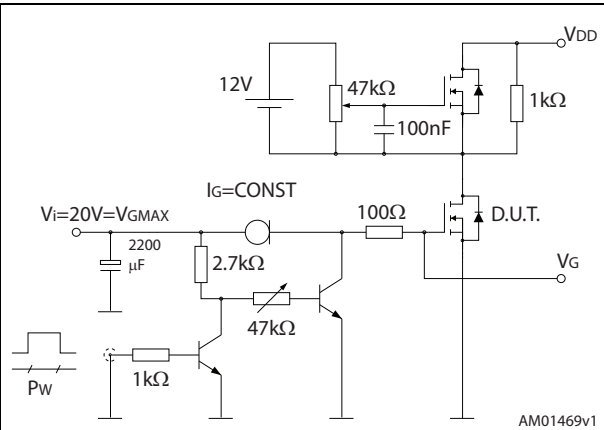


# 4 Test circuits

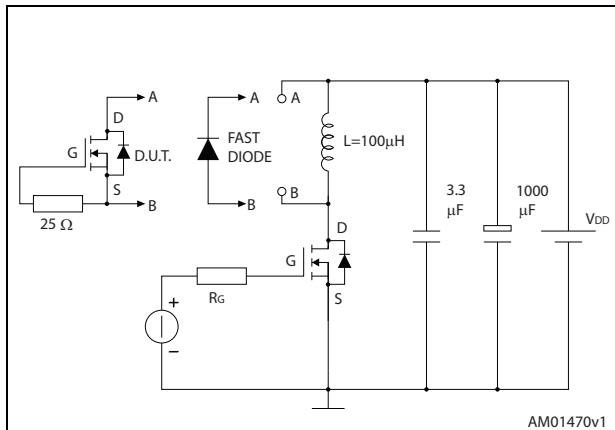
**Figure 18. Switching times test circuit for resistive load**



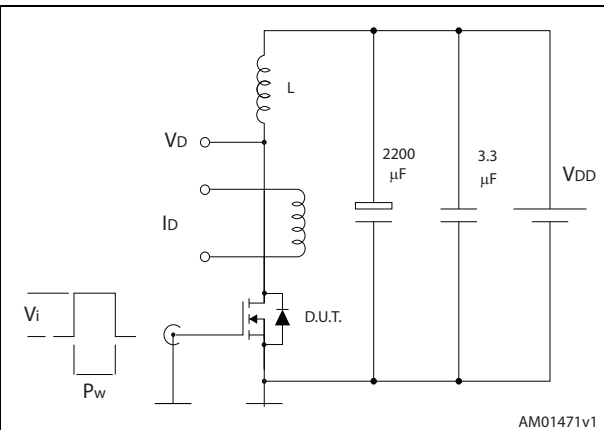
**Figure 19. Gate charge test circuit**



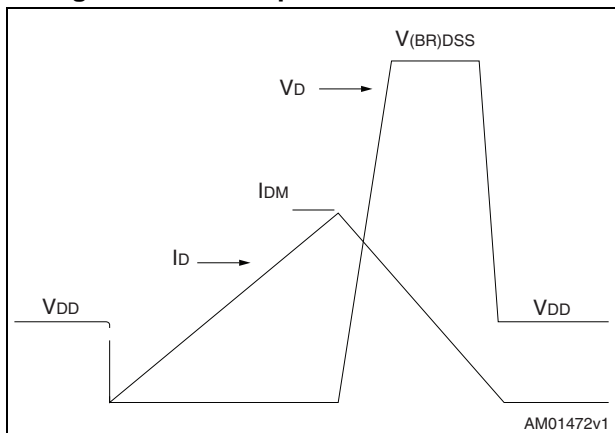
**Figure 20. Test circuit for inductive load switching and diode recovery times**



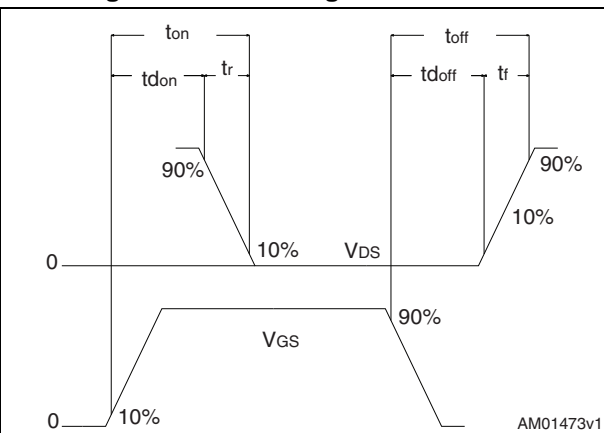
**Figure 21. Unclamped inductive load test circuit**



**Figure 22. Unclamped inductive waveform**



**Figure 23. Switching time waveform**



## 5 Package information

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.

### 5.1 H<sup>2</sup>PAK-2 package information

Figure 24. H<sup>2</sup>PAK-2 package information

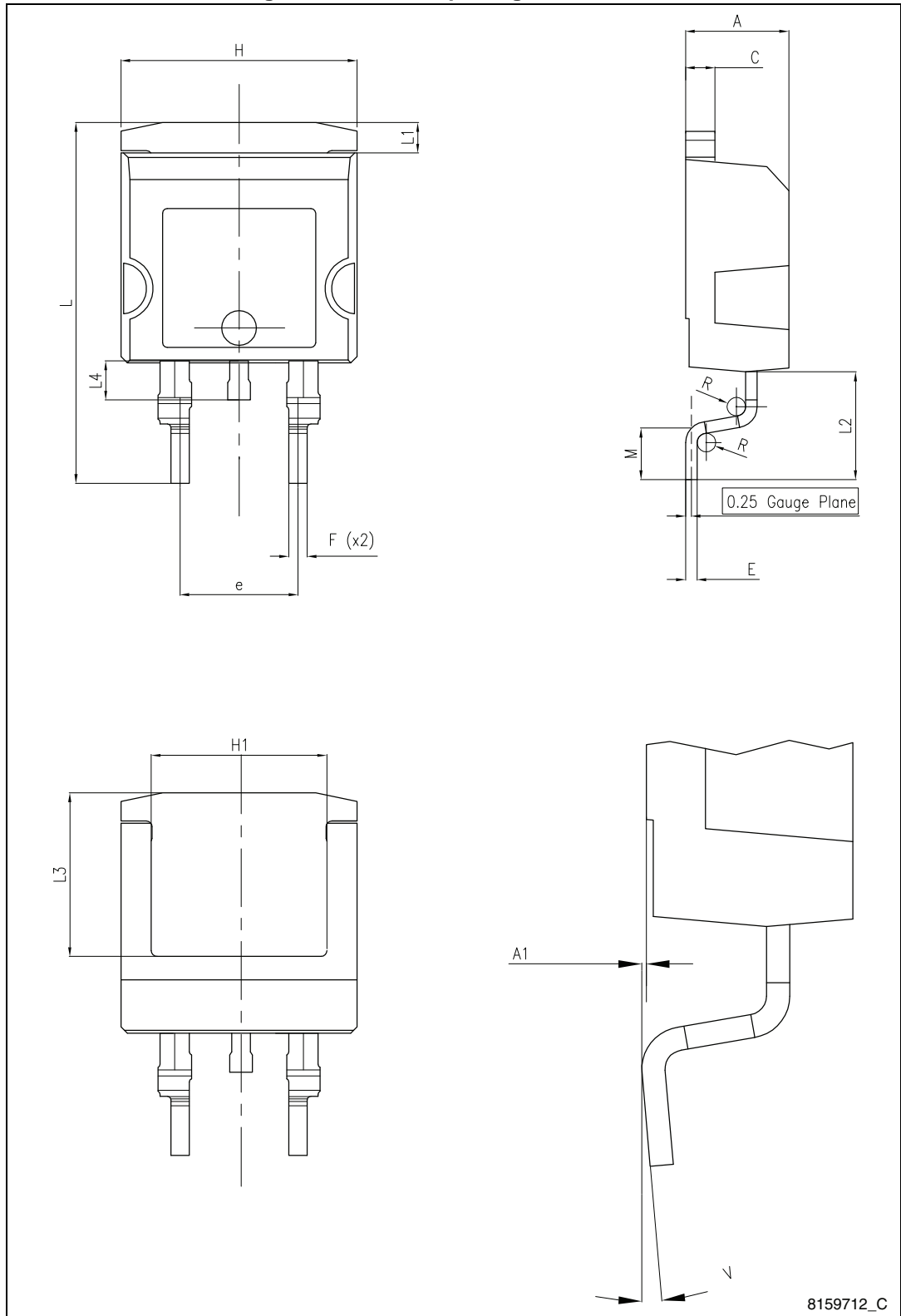
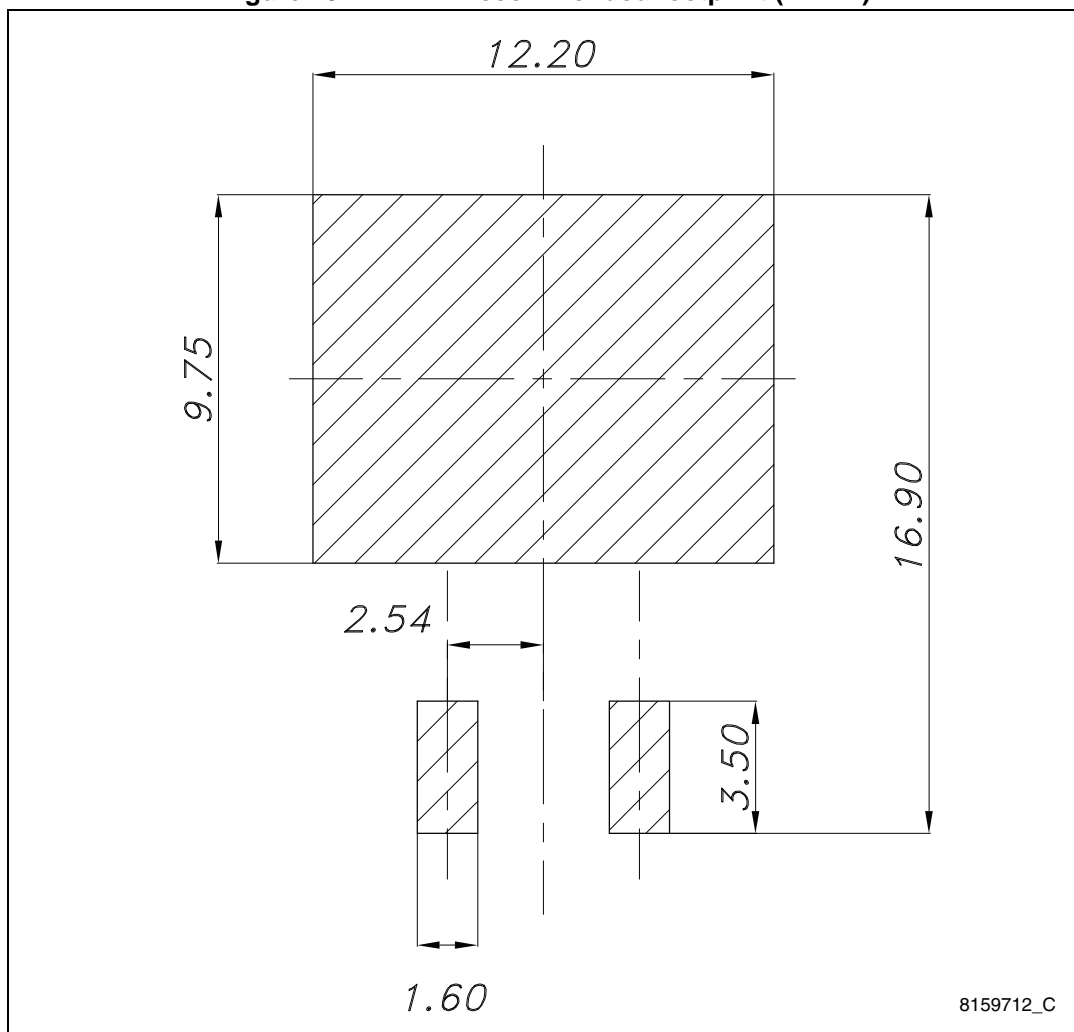


Table 8. H<sup>2</sup>PAK-2 package mechanical data

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 25. H<sup>2</sup>PAK-2 recommended footprint (in mm)



8159712\_C

## 5.2 H<sup>2</sup>PAK-6 package information

Figure 26. H<sup>2</sup>PAK-6 package outline

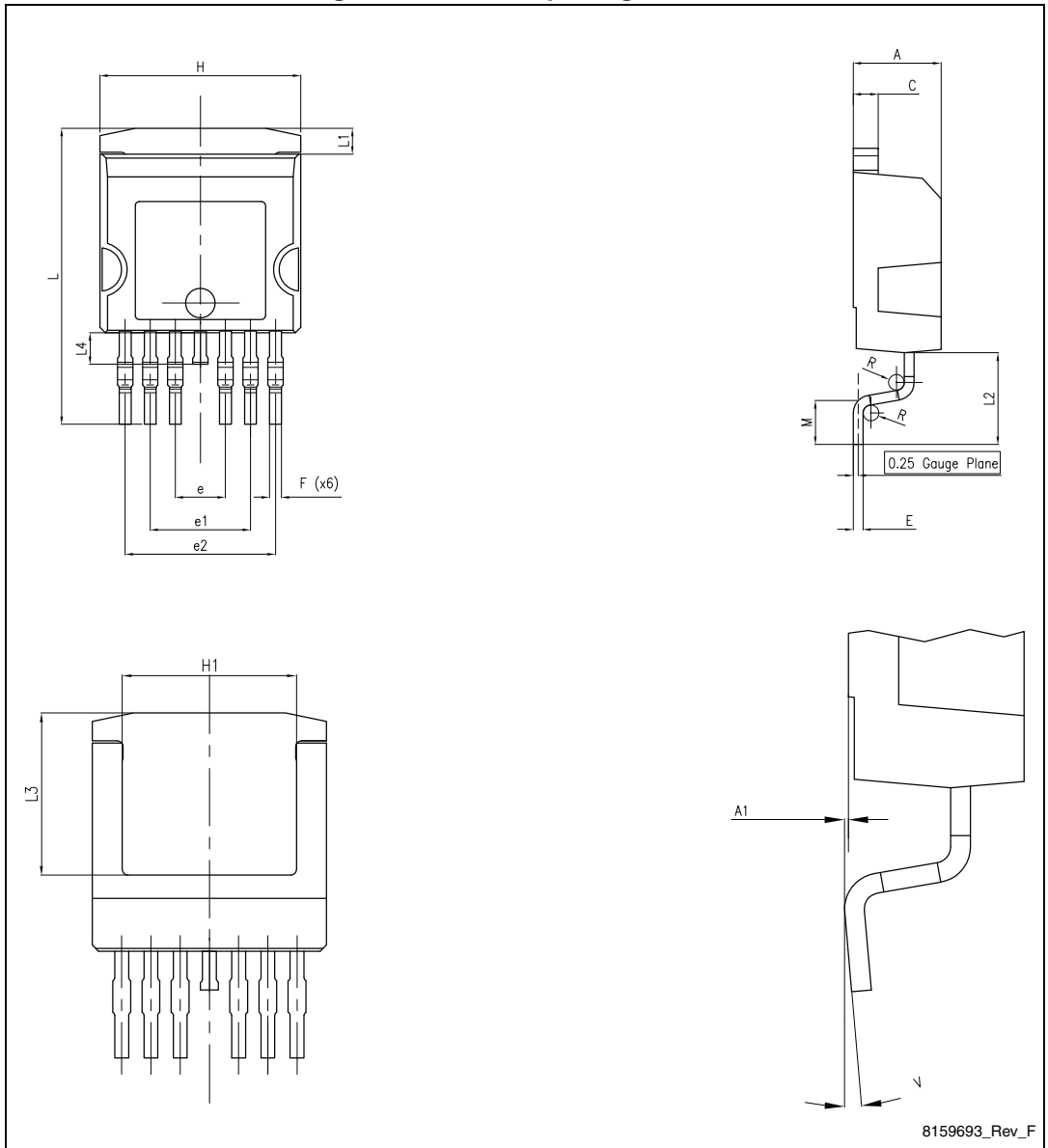
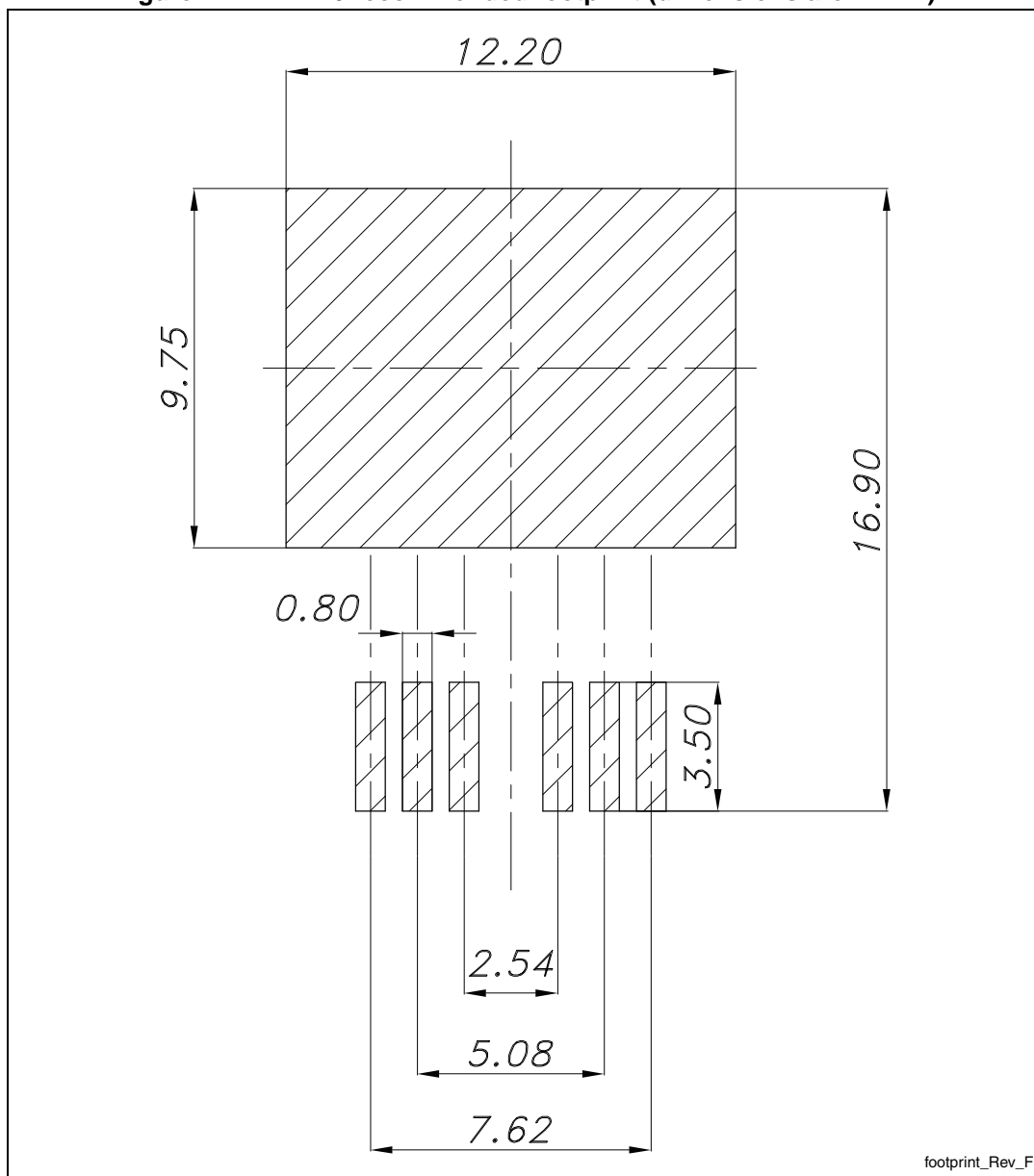


Table 9. H<sup>2</sup>PAK-6 package mechanical data

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 27. H<sup>2</sup>PAK-6 recommended footprint (dimensions are in mm)





### 5.3 TO-220 type A package information

Figure 28. TO-220 type A package outline

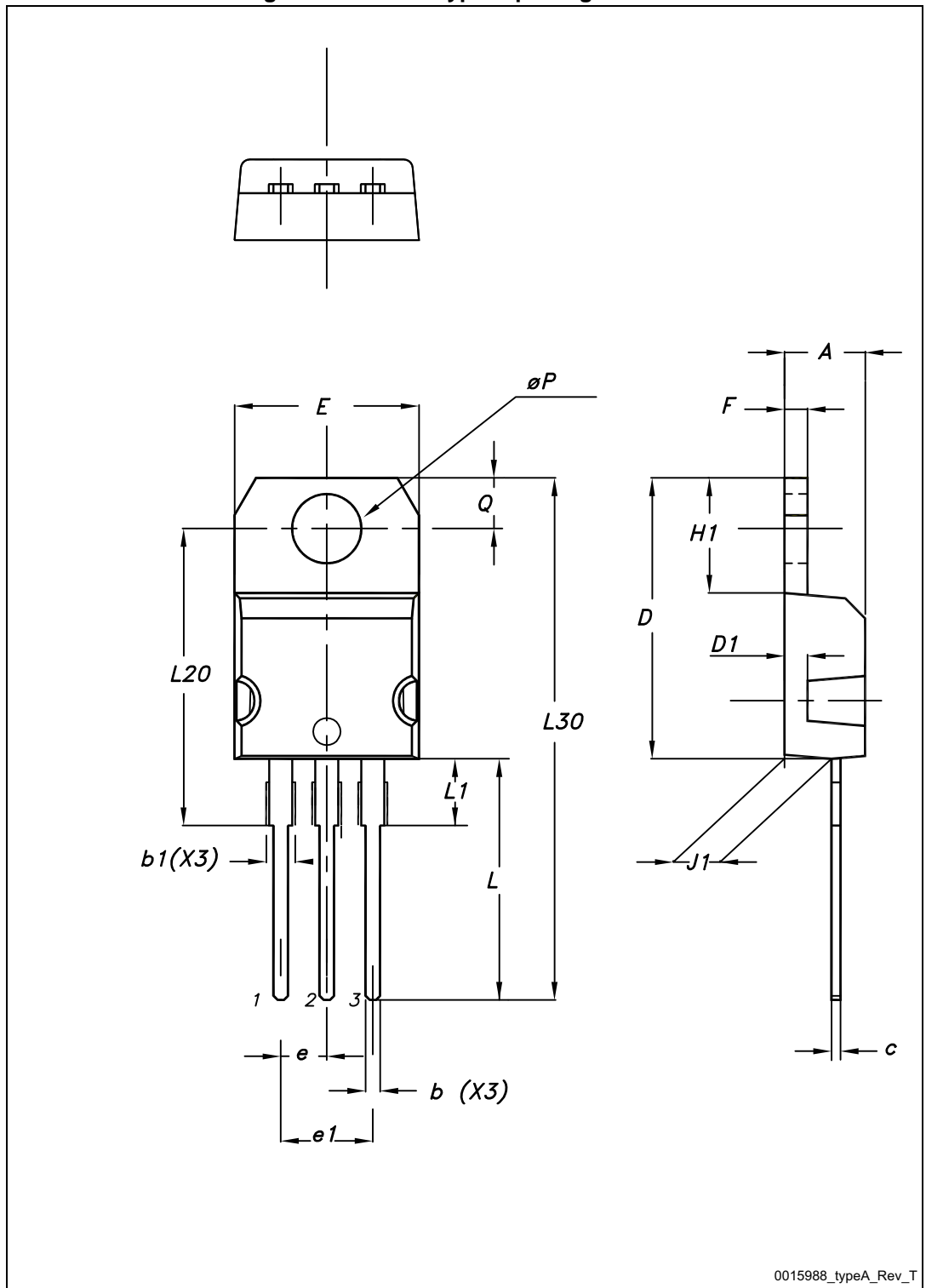


Table 10. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

# 6 Packing information

Figure 29. Tape

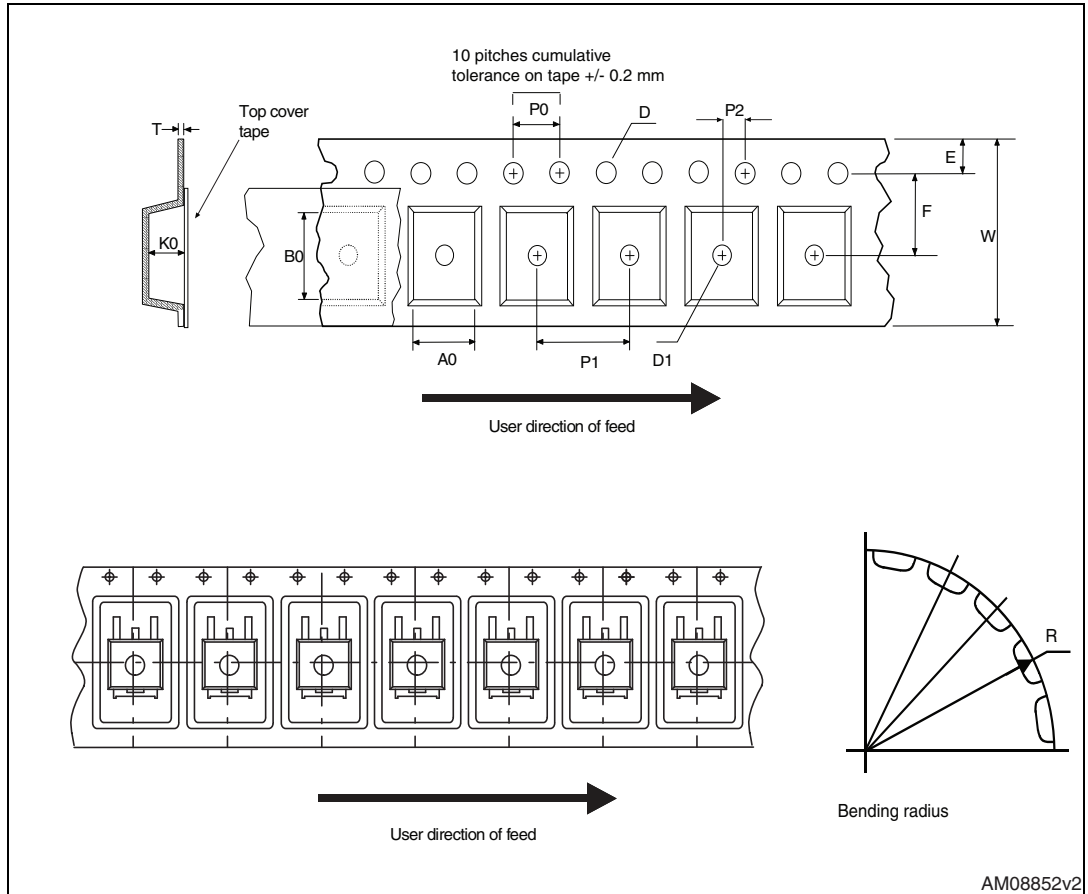


Figure 30. Reel

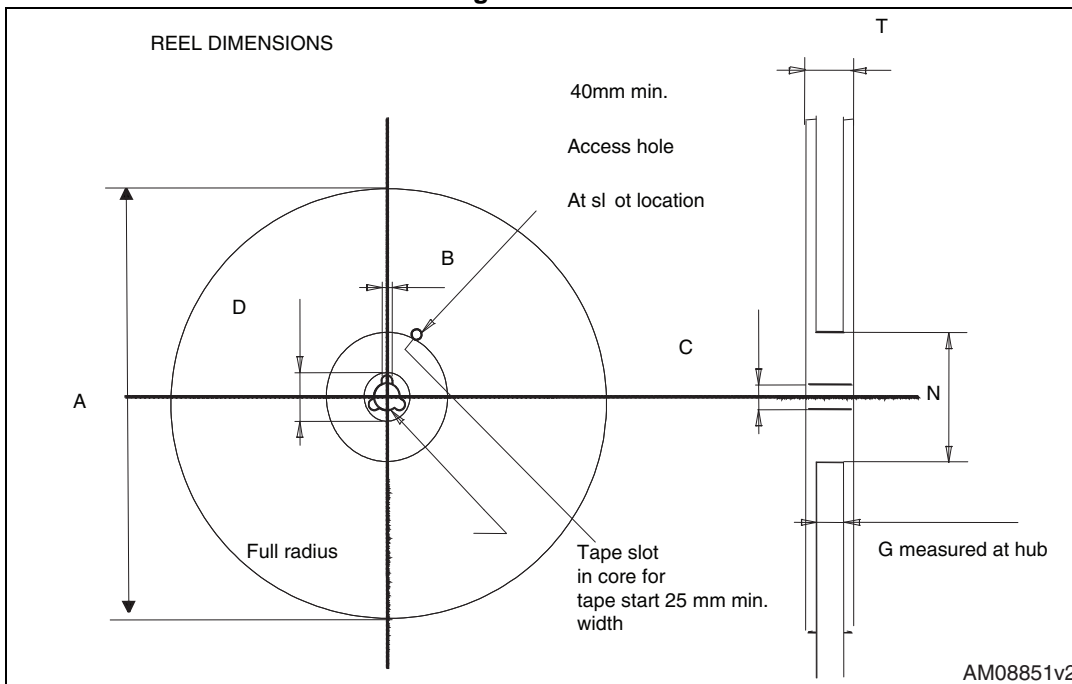


Table 11. H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6 tape and reel mechanical data

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			

## 7 Revision history

**Table 12. Document revision history**

Date	Revision	Changes
03-Dec-2012	1	First release.
09-Apr-2013	2	<ul style="list-style-type: none"> <li>– Modified: <math>R_{DS(on)}</math> max values on <a href="#">Features</a> table, <math>I_{DSS}</math>, <math>I_{GSS}</math> values on <a href="#">Table 4</a>, <math>R_{DS(on)}</math> value for H<sup>2</sup>PAK-2, the entire typical values on <a href="#">Table 5</a> and <a href="#">6</a>, <math>V_{SD}</math> test conditions and max values, <math>T_{RR}</math>, <math>Q_{RR}</math>, <math>I_{RRM}</math> typical values on <a href="#">Table 7</a></li> <li>– Inserted: <a href="#">Section 3: Electrical characteristics (curves)</a></li> <li>– Document status promoted to preliminary data to production data</li> <li>– Added: H<sup>2</sup>PAK-6 package</li> <li>– Minor text changes</li> </ul>
11-Oct-2013	3	<ul style="list-style-type: none"> <li>– Modified: <math>C_{rSS}</math> typical value in <a href="#">Table 5</a></li> <li>– Updated: <a href="#">Section 5: Package information</a></li> <li>– Updated: <a href="#">Figure 18</a>, <a href="#">19</a>, <a href="#">20</a> and <a href="#">21</a></li> <li>– Minor text changes</li> </ul>
14-May-2015	4	<ul style="list-style-type: none"> <li>– Updated title, features and description in cover page.</li> <li>– Minor text changes</li> </ul>

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