

## Automotive-grade N-channel 24 V, 0.95 mΩ typ., 180 A STripFET™ III Power MOSFET in a H<sup>2</sup>PAK-6 package

Datasheet – production data

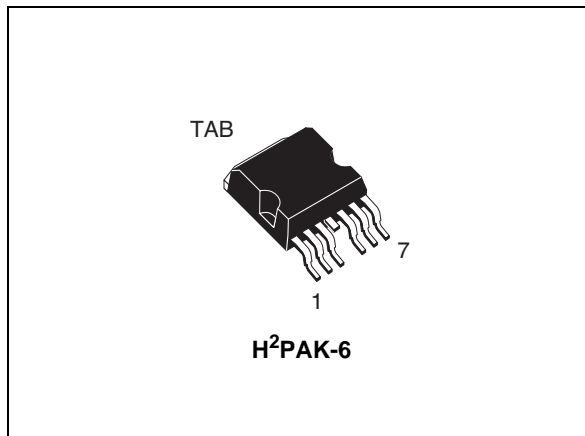
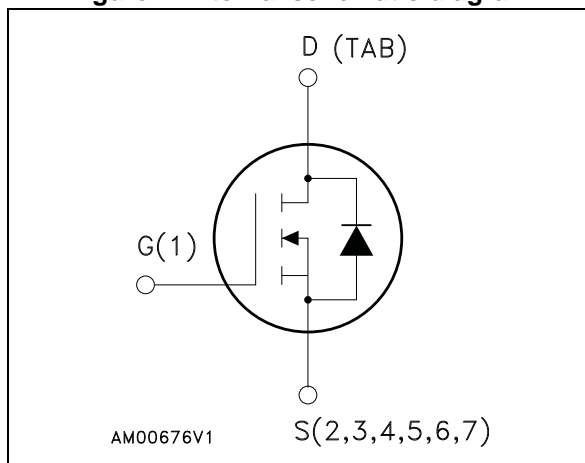


Figure 1. Internal schematic diagram



### Features

Order code	V <sub>DSS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub> <sup>(1)</sup>
STH300NH02L-6	24 V	< 1.2 mΩ	180 A

1. Current limited by package.

- Designed for automotive applications and AEC-Q101 qualified
- Conduction losses reduced
- Low profile, very low parasitic inductance, high current package

### Applications

- Switching applications

### Description

This device is an N-channel enhancement mode Power MOSFET produced using STMicroelectronics' STripFET™ III technology, which is specifically designed to minimize on-resistance and gate charge to provide superior switching performance.

Table 1. Device summary

Order code	Marking	Package	Packaging
STH300NH02L-6	300NH02L	H <sup>2</sup> PAK-6	Tape and reel

---

# Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>4</b>
2.1	Electrical characteristics (curves) .....	6
<b>3</b>	<b>Test circuits</b> .....	<b>8</b>
<b>4</b>	<b>Package mechanical data</b> .....	<b>9</b>
<b>5</b>	<b>Packaging mechanical data</b> .....	<b>13</b>
<b>6</b>	<b>Revision history</b> .....	<b>15</b>

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	24	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	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 $T_C = 25\text{ }^\circ\text{C}$	300	W
	Derating factor	2	W/ $^\circ\text{C}$
$E_{AS}^{(4)}$	Single pulse avalanche energy	1.6	J
$T_{stg}$	Storage temperature	-55 to 175	$^\circ\text{C}$
$T_j$	Operating junction temperature		

1. Current limited by package
2. Pulse width limited by safe operating area
3. This value is rated according to  $R_{thj-c}$
4. Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = 60\text{ A}$ ,  $V_{DD} = 20\text{ V}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.5	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	35	$^\circ\text{C}/\text{W}$

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

## 2 Electrical characteristics

(T<sub>case</sub> = 25 °C unless otherwise specified)

**Table 4. On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage (V <sub>GS</sub> = 0)	I <sub>D</sub> = 250 μA	24			V
I <sub>DSS</sub>	Zero gate voltage drain current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = 24 V, V <sub>DS</sub> = 24 V, T <sub>C</sub> = 125 °C			1 10	μA μA
I <sub>GSS</sub>	Gate body leakage current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 20 V			± 100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1			V
R <sub>DS(on)</sub>	Static drain-source on-resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 80 A V <sub>GS</sub> = 5 V, I <sub>D</sub> = 40 A		0.95 1.15	1.2 1.5	mΩ

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 15 V, f = 1 MHz, V <sub>GS</sub> = 0	-	7050	-	pF
C <sub>oss</sub>	Output capacitance		-	3250	-	pF
C <sub>rss</sub>	Reverse transfer capacitance		-	307	-	pF
Q <sub>g</sub>	Total gate charge	V <sub>DD</sub> = 20 V, I <sub>D</sub> = 120 A, V <sub>GS</sub> = 10 V (see Figure 14)	-	109	-	nC
Q <sub>gs</sub>	Gate-source charge		-	30	-	nC
Q <sub>gd</sub>	Gate-drain charge		-	26	-	nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub>	Turn-on delay time	V <sub>DD</sub> = 20 V, I <sub>D</sub> = 80 A R <sub>G</sub> = 4.7 Ω, V <sub>GS</sub> = 10 V, (see Figure 13)	-	18	-	ns
t <sub>r</sub>	Rise time		-	275	-	ns
t <sub>d(off)</sub>	Turn-off delay time	V <sub>DD</sub> = 20 V, I <sub>D</sub> = 80 A R <sub>G</sub> = 4.7 Ω, V <sub>GS</sub> = 10 V, (see Figure 13)	-	138	-	ns
t <sub>f</sub>	Fall time		-	94.4	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Source-drain current		-		180	A
$I_{SD}^{(2)}$	Source-drain current (pulsed)		-		720	A
$V_{SD}^{(3)}$	Forward on voltage	$I_{SD} = 180 \text{ A}, V_{GS} = 0$	-		1.3	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 120 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$	-	65		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 20 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$	-	90		nC
$I_{RRM}$	Reverse recovery current	(see Figure 15)	-	2.8		A

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

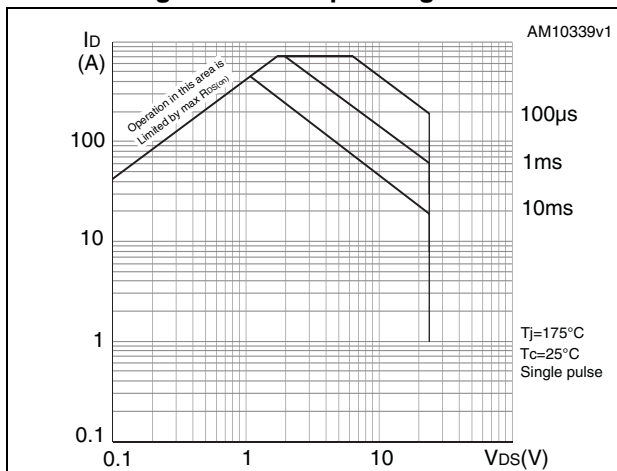


Figure 3. Thermal impedance

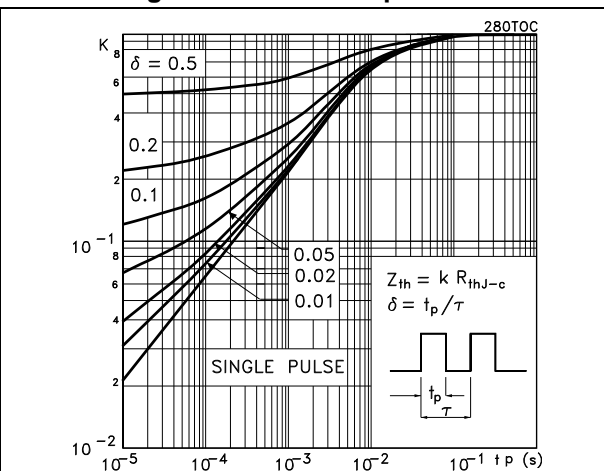


Figure 4. Output characteristics

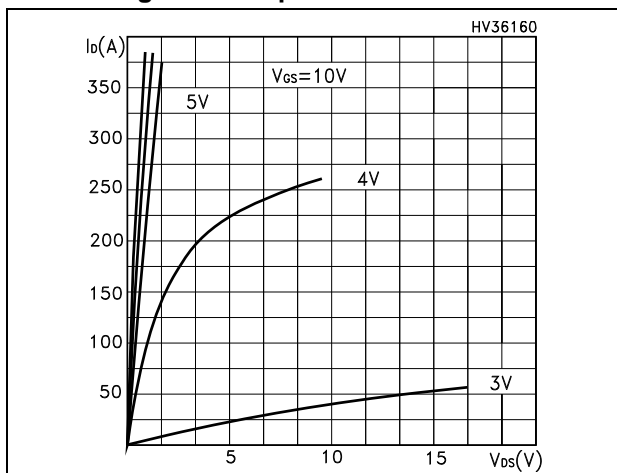


Figure 5. Transfer characteristics

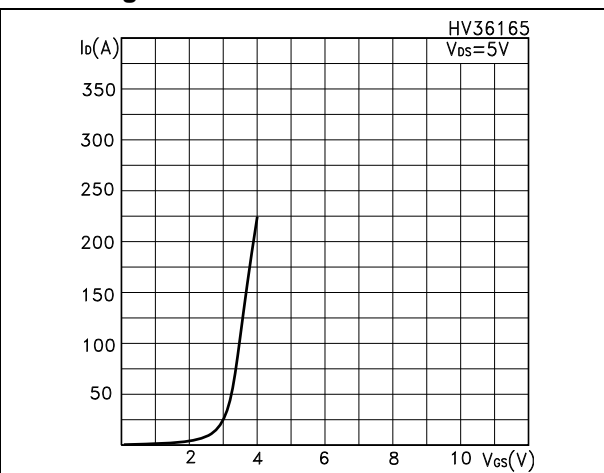


Figure 6. Normalized B<sub>VDS</sub> vs temperature

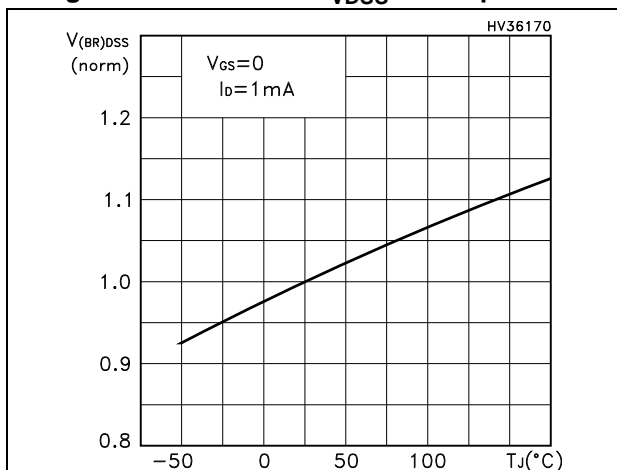


Figure 7. Static drain-source on-resistance

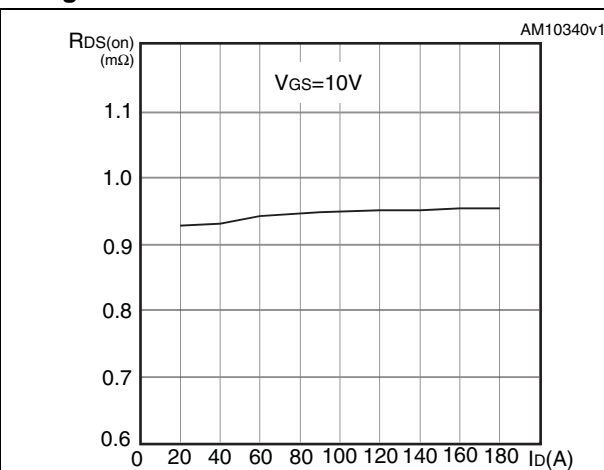


Figure 8. Gate charge vs gate-source voltage

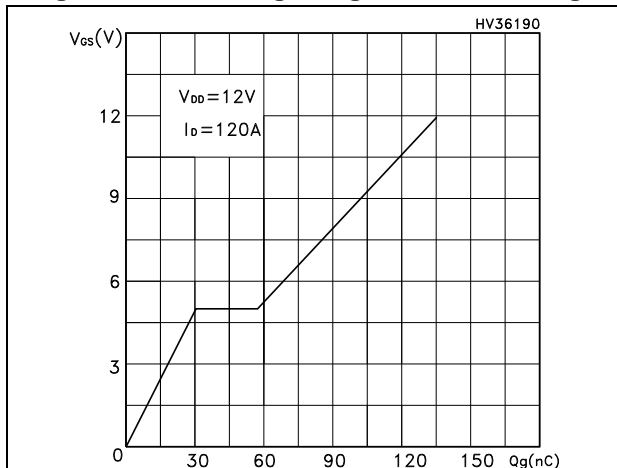


Figure 9. Capacitance variations

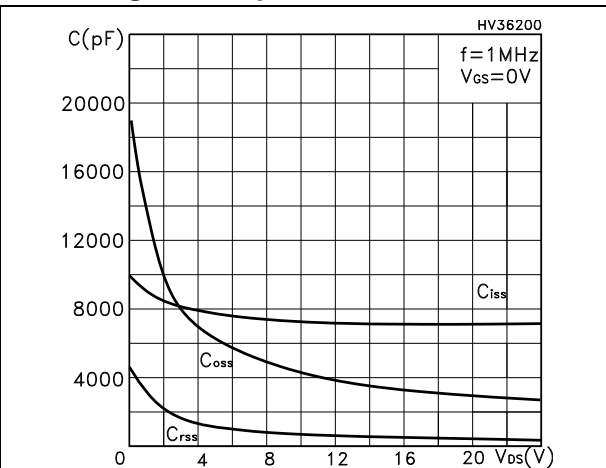


Figure 10. Normalized gate threshold voltage vs temperature

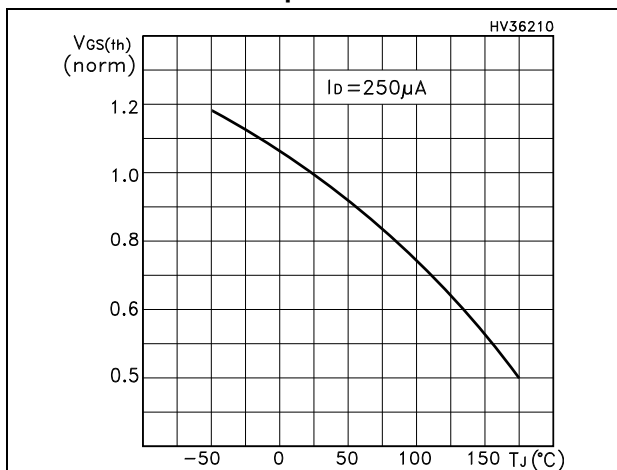


Figure 11. Normalized on resistance vs temperature

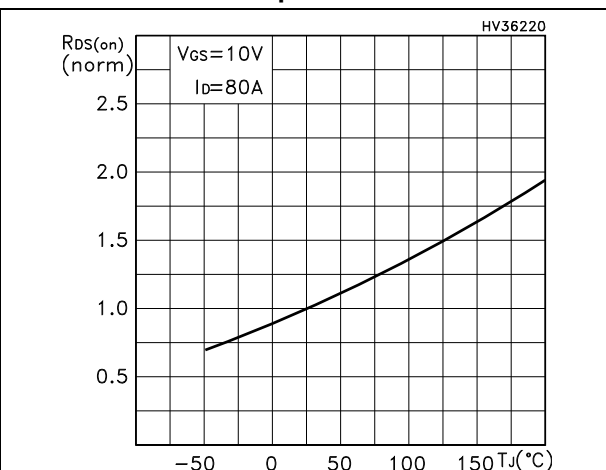
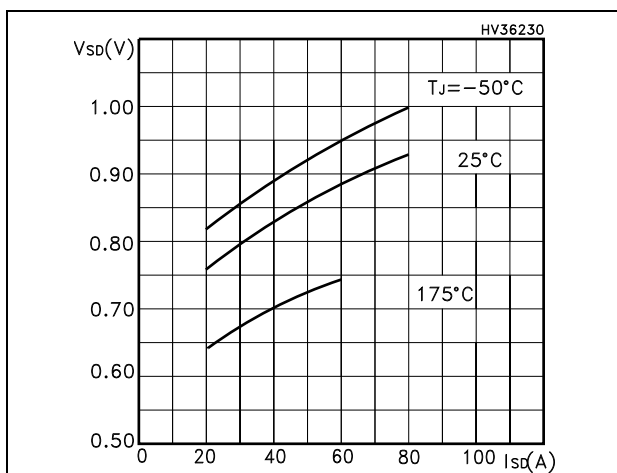
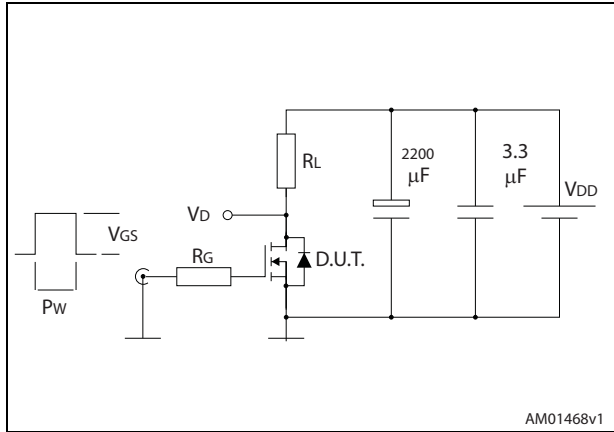


Figure 12. Source-drain diode forward characteristics

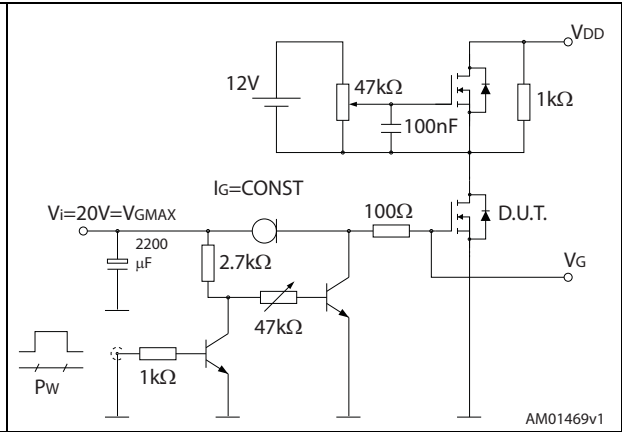


### 3 Test circuits

**Figure 13. Switching times test circuit for resistive load**



**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 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.

**Table 8. H<sup>2</sup>PAK-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 19. H<sup>2</sup>PAK-6 drawing

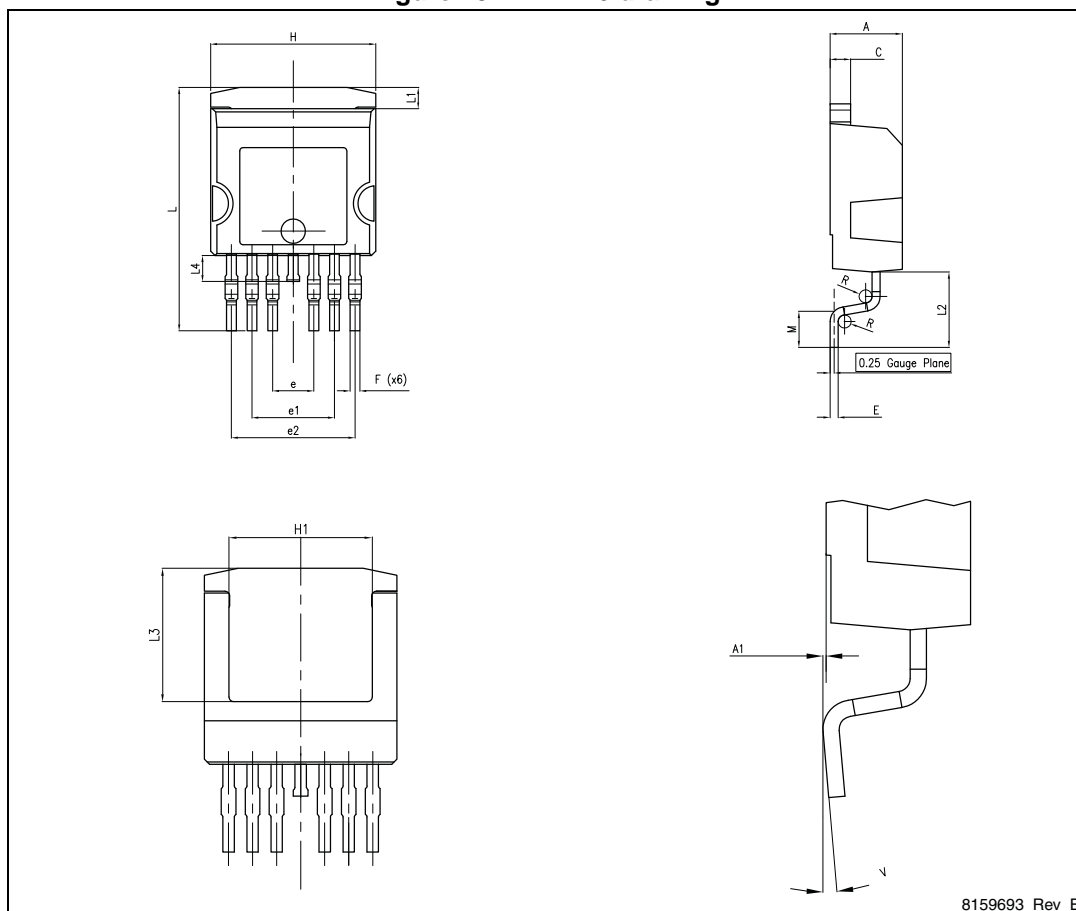
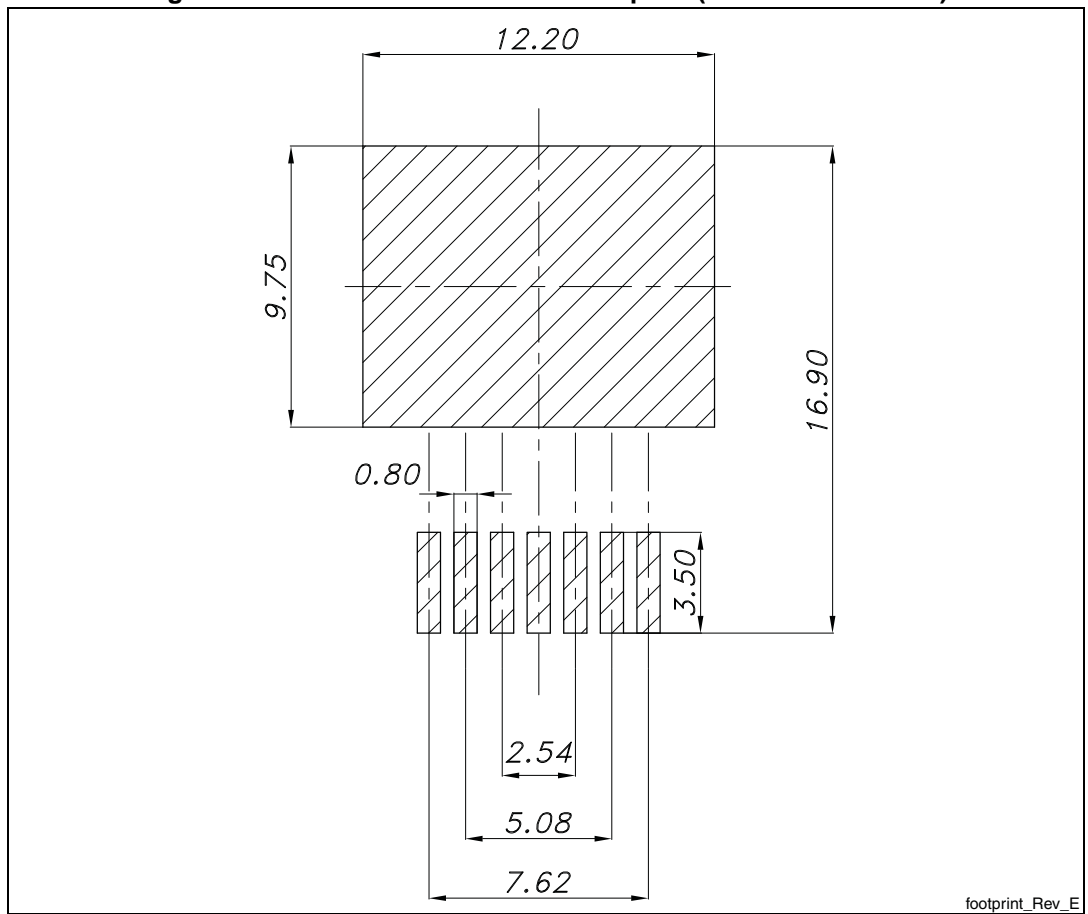


Figure 20. H<sup>2</sup>PAK-6 recommended footprint (dimensions in mm)



footprint\_Rev\_E

## 5 Packaging mechanical data

Table 9. 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			

Figure 21. Tape

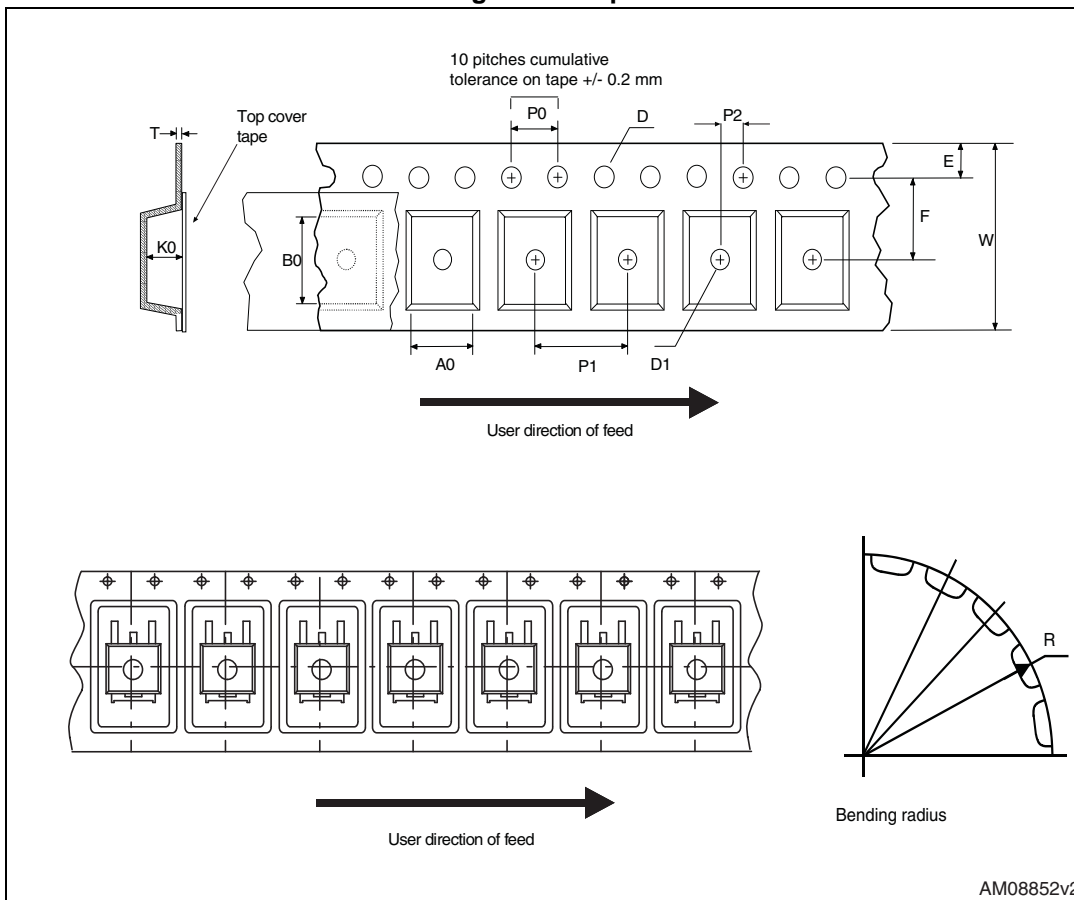
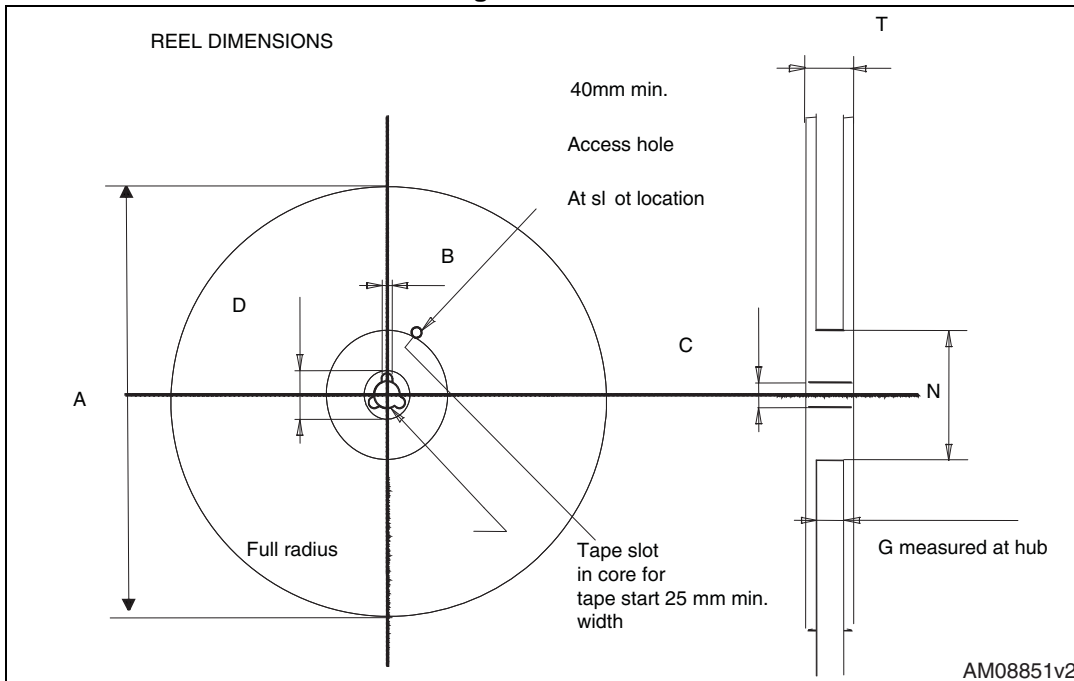


Figure 22. Reel



## 6 Revision history

Table 10. Document revision history

Date	Revision	Changes
12-Jul-2011	1	initial release
24-Oct-2011	2	Updated test conditions in <a href="#">Section Table 5.: Dynamic</a> and <a href="#">Section Table 7.: Source drain diode</a> .
15-May-2013	3	– Updated: title, <a href="#">Applications</a> and <a href="#">Description</a> in cover page – Minor text changes
22-Jul-2013	4	– Updated title in cover page.

**Please Read Carefully:**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**ST PRODUCTS ARE NOT AUTHORIZED FOR USE IN WEAPONS. NOR ARE ST PRODUCTS DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER'S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR "AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL" INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2013 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

[www.st.com](http://www.st.com)

