

## Excellent Integrated System Limited

Stocking Distributor

Click to view price, real time Inventory, Delivery & Lifecycle Information:

[STMicroelectronics](#)  
[STD96N3LLH6](#)

For any questions, you can email us directly:

[sales@integrated-circuit.com](mailto:sales@integrated-circuit.com)



# STD96N3LLH6

N-channel 30 V, 0.0037  $\Omega$ , 80 A, DPAK  
 STripFET™ VI DeepGATE™ Power MOSFET

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on) max</sub>	I <sub>D</sub>
STD96N3LLH6	30 V	0.0042 $\Omega$	80 A

- R<sub>DS(on)</sub> \* Q<sub>g</sub> industry benchmark
- Extremely low on-resistance R<sub>DS(on)</sub>
- High avalanche ruggedness
- Low gate drive power losses

## Application

- Switching applications
  - Automotive

## Description

This product is an N-channel Power MOSFET that utilizes the 6<sup>th</sup> generation of design rules of ST's proprietary STripFET™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R<sub>DS(on)</sub> in all packages.

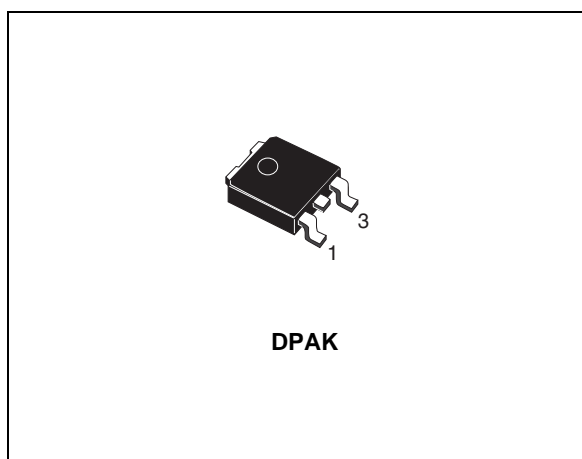


Figure 1. Internal schematic diagram

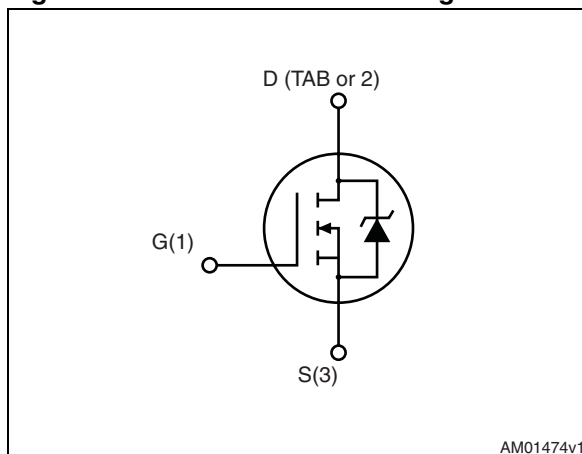


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD96N3LLH6	96N3LLH6	DPAK	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>10</b>
<b>5</b>	<b>Packaging mechanical data</b> .....	<b>12</b>
<b>6</b>	<b>Revision history</b> .....	<b>14</b>

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	30	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	80	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	61	A
$I_{DM}^{(2)}$	Drain current (pulsed)	320	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	70	W
	Derating factor	0.47	W/ $^\circ\text{C}$
$E_{AS}^{(3)}$	Single pulse avalanche energy	150	mJ
$T_{stg}$	Storage temperature	-55 to 175	$^\circ\text{C}$
$T_j$	Max. operating junction temperature	175	$^\circ\text{C}$

- Limited by wire bonding.
- Pulse width limited by safe operating area.
- Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_{AV} = 55\text{ A}$ ,  $L = 0.1\text{ mH}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	2.14	$^\circ\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	100	$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	35	$^\circ\text{C/W}$
$T_l$	Maximum lead temperature for soldering purpose	275	$^\circ\text{C}$

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

Electrical characteristics

STD96N3LLH6

## 2 Electrical characteristics

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

**Table 4. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0	30			V
I <sub>DSS</sub>	Zero gate voltage drain current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = 30 V V <sub>DS</sub> = 30 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		2.5	V
R <sub>DS(on)</sub>	Static drain-source on resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 40 A		0.0037	0.0042	Ω
		V <sub>GS</sub> = 5.5 V, I <sub>D</sub> = 40 A		0.0055	0.007	Ω

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
C <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 25 V, f=1 MHz, V <sub>GS</sub> = 0	-	2200	-	pF
C <sub>OSS</sub>	Output capacitance			400		pF
C <sub>rss</sub>	Reverse transfer capacitance			280		pF
Q <sub>g</sub>	Total gate charge	V <sub>DD</sub> = 15 V, I <sub>D</sub> = 80 A	-	20	-	nC
Q <sub>gs</sub>	Gate-source charge	V <sub>GS</sub> = 4.5 V		8.2		nC
Q <sub>gd</sub>	Gate-drain charge	<i>Figure 13</i>		7.5		nC
Q <sub>gs1</sub>	Pre V <sub>th</sub> gate-to-source charge	V <sub>DD</sub> = 15 V, I <sub>D</sub> = 80 A <i>Figure 18</i>	-	3.4	-	nC
Q <sub>gs2</sub>	Post V <sub>th</sub> gate-to-source charge			6.2		nC
R <sub>G</sub>	Gate input resistance	f = 1 MHz gate bias Bias = 0 test signal level = 20 mV open drain	-	1	-	Ω

**STD96N3LLH6**
**Electrical characteristics**
**Table 6. Switching on/off (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 15\text{ V}$ , $I_D = 40\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 5\text{ V}$ <i>Figure 12</i>	-	19	-	ns
$t_r$	Rise time			91		ns
$t_{d(off)}$	Turn-off delay time	$V_{DD} = 15\text{ V}$ , $I_D = 40\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 5\text{ V}$ <i>Figure 12</i>	-	24.5	-	ns
$t_f$	Fall time			23.4		ns

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		80	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				320	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 40\text{ A}$ , $V_{GS} = 0$	-		1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 80\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 24\text{ V}$ <i>Figure 14</i>	-	28.6		ns
$Q_{rr}$	Reverse recovery charge			22.8		nC
$I_{RRM}$	Reverse recovery current			1.6		A

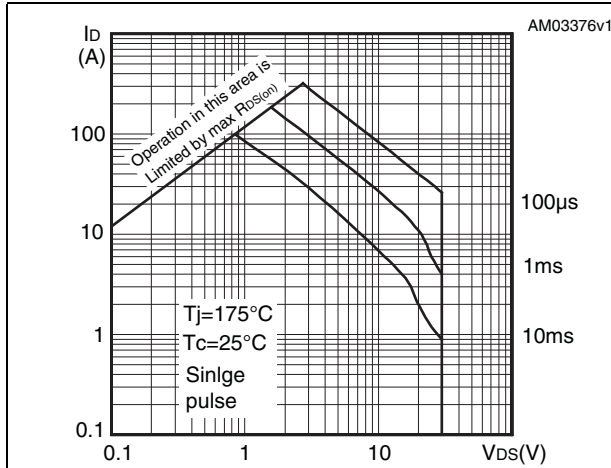
1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

**Electrical characteristics**

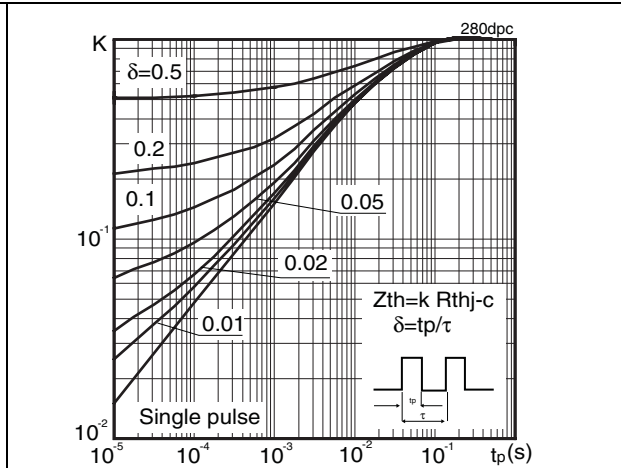
**STD96N3LLH6**

**2.1 Electrical characteristics (curves)**

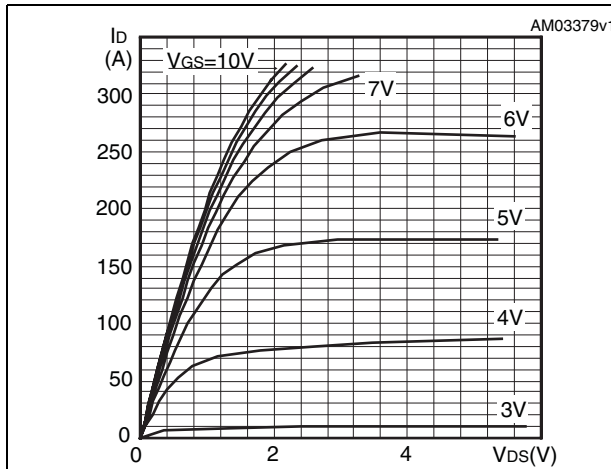
**Figure 2. Safe operating area**



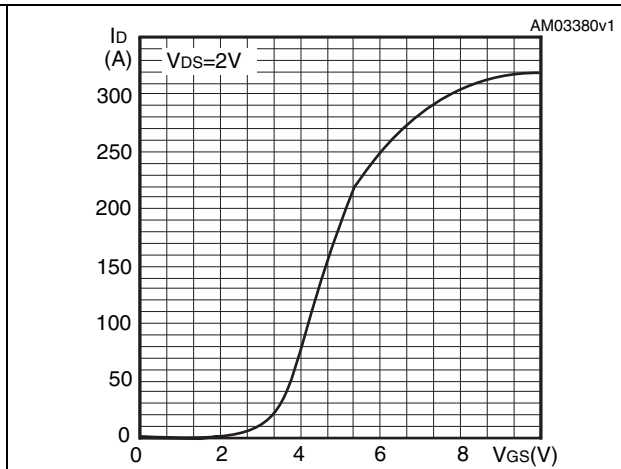
**Figure 3. Thermal impedance**



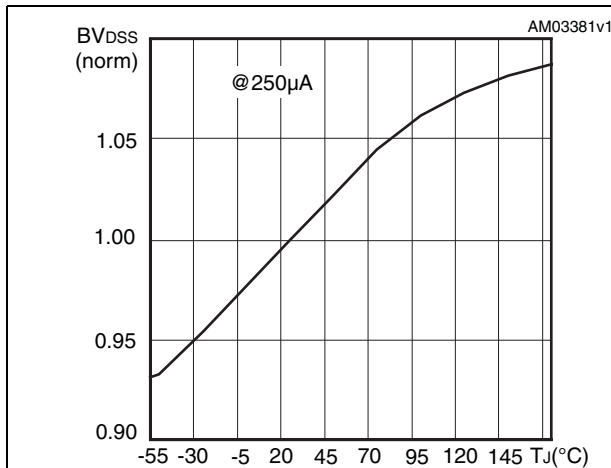
**Figure 4. Output characteristics**



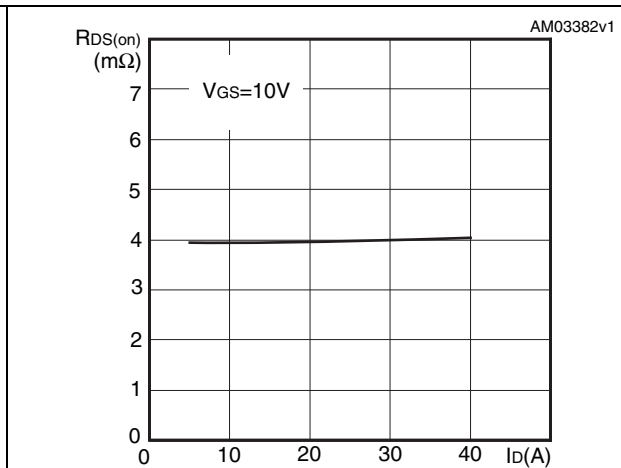
**Figure 5. Transfer characteristics**



**Figure 6. Normalized BV<sub>DSS</sub> vs temperature**



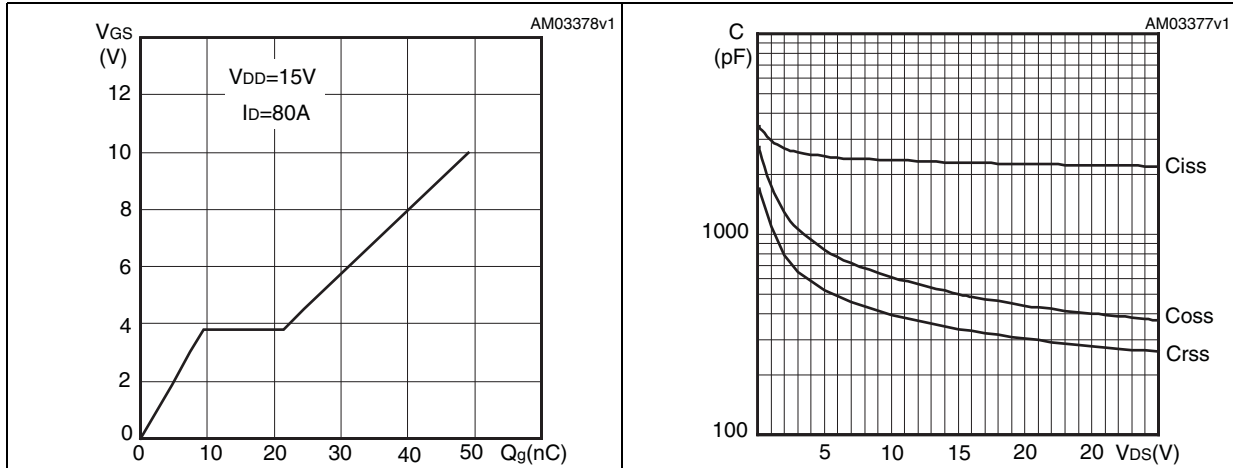
**Figure 7. Static drain source on resistance**



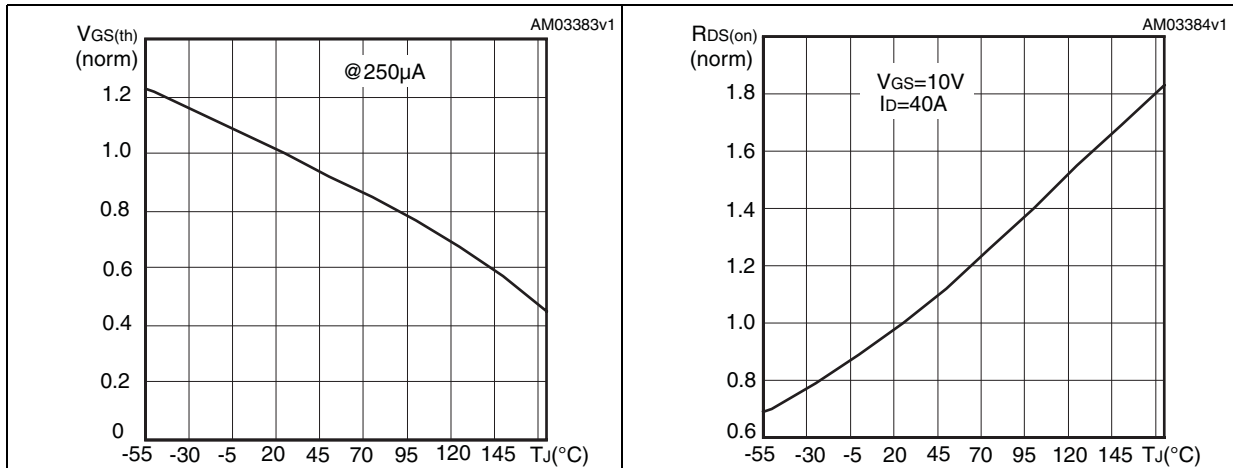
**STD96N3LLH6**

**Electrical characteristics**

**Figure 8. Gate charge vs gate-source voltage** **Figure 9. Capacitance variations**



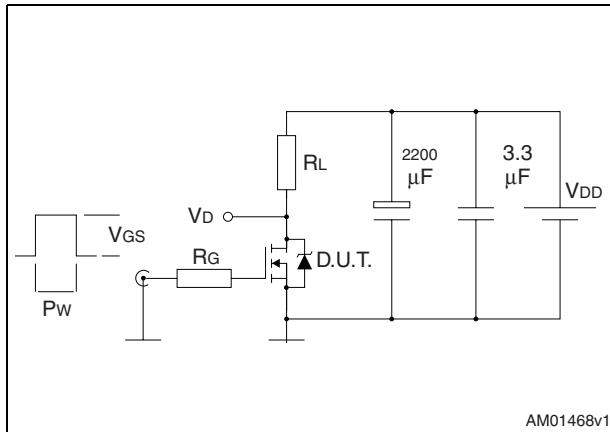
**Figure 10. Normalized gate threshold voltage vs temperature** **Figure 11. Normalized on resistance vs temperature**



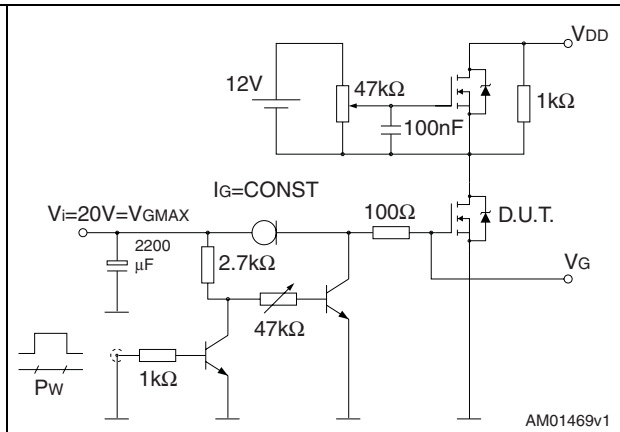


### 3 Test circuits

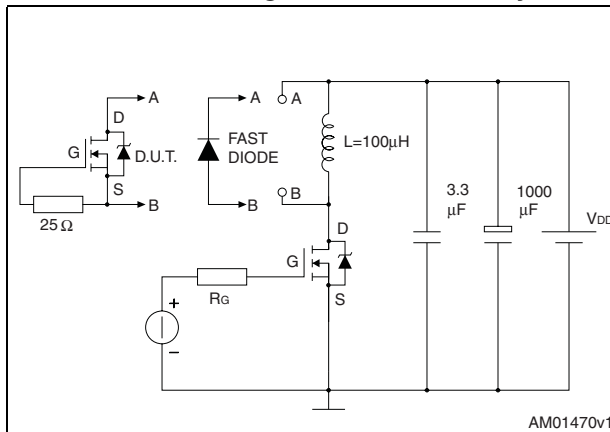
**Figure 12. Switching times test circuit for resistive load**



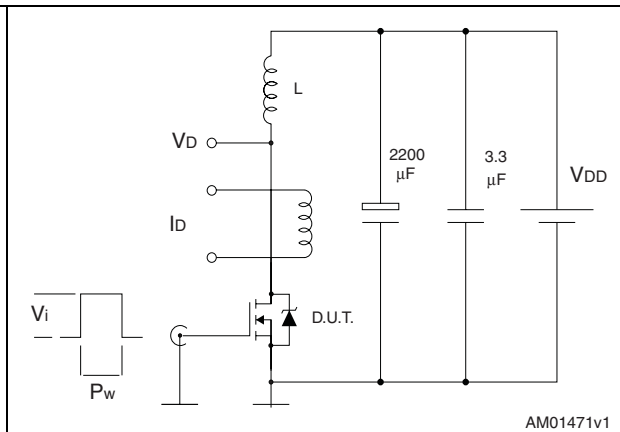
**Figure 13. Gate charge test circuit**



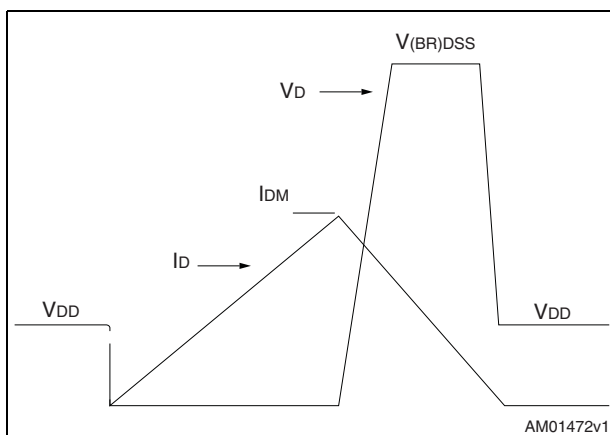
**Figure 14. Test circuit for inductive load switching and diode recovery times**



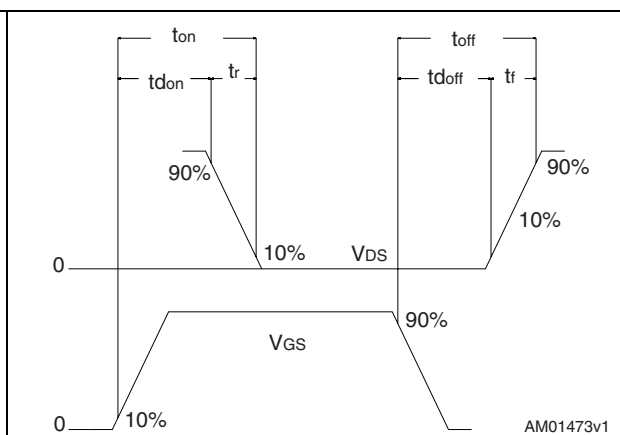
**Figure 15. Unclamped inductive load test circuit**



**Figure 16. Unclamped inductive waveform**



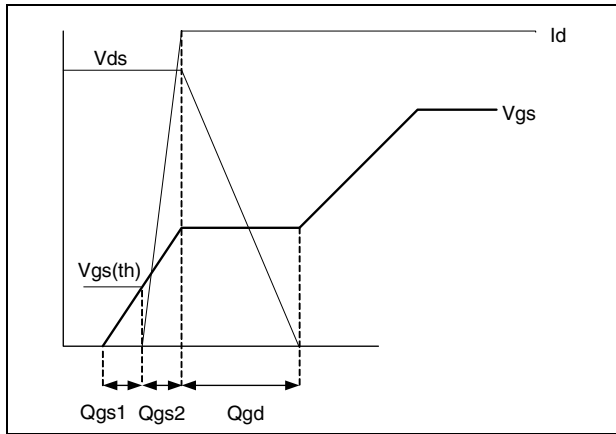
**Figure 17. Switching time waveform**



**STD96N3LLH6**

**Test circuits**

**Figure 18. 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 is an ST trademark.

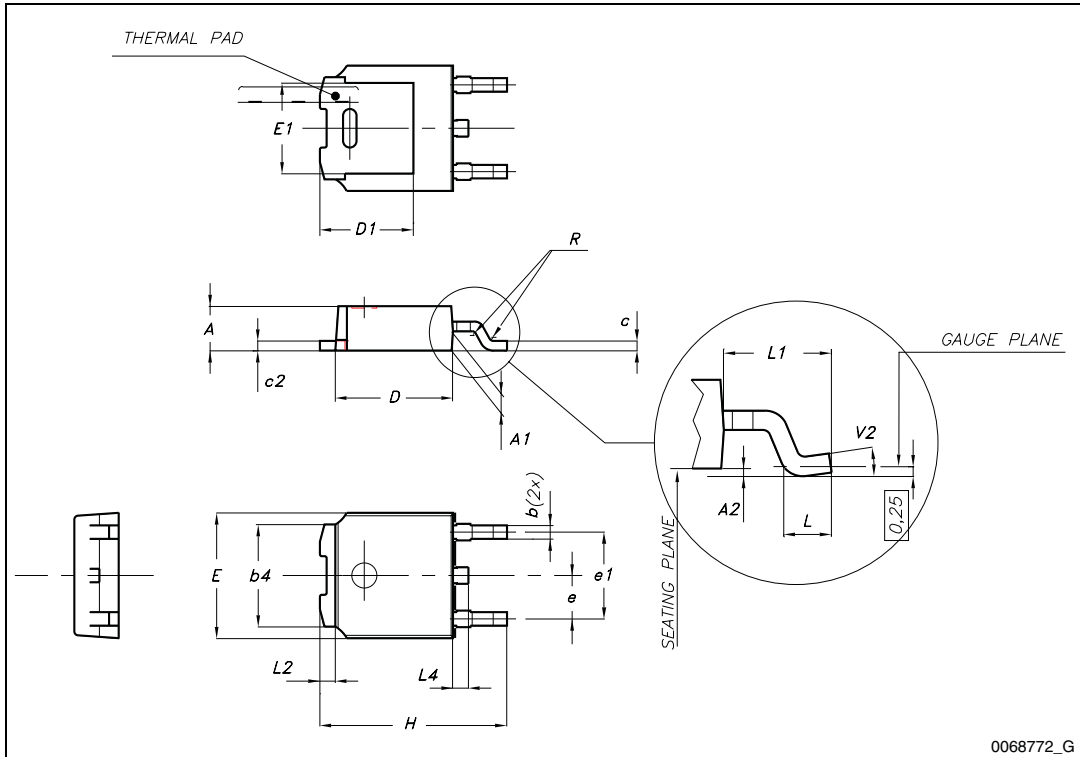
**Table 8. DPAK (TO-252) mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°

**STD96N3LLH6**

**Package mechanical data**

**Figure 19. DPAK (TO-252) drawing**



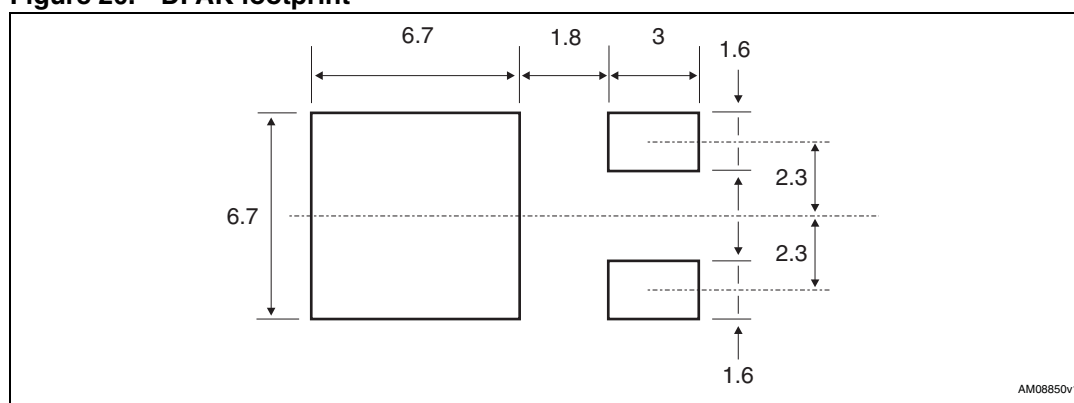
0068772\_G

## 5 Packaging mechanical data

Table 9. DPAK (TO-252) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

Figure 20. DPAK footprint<sup>(a)</sup>

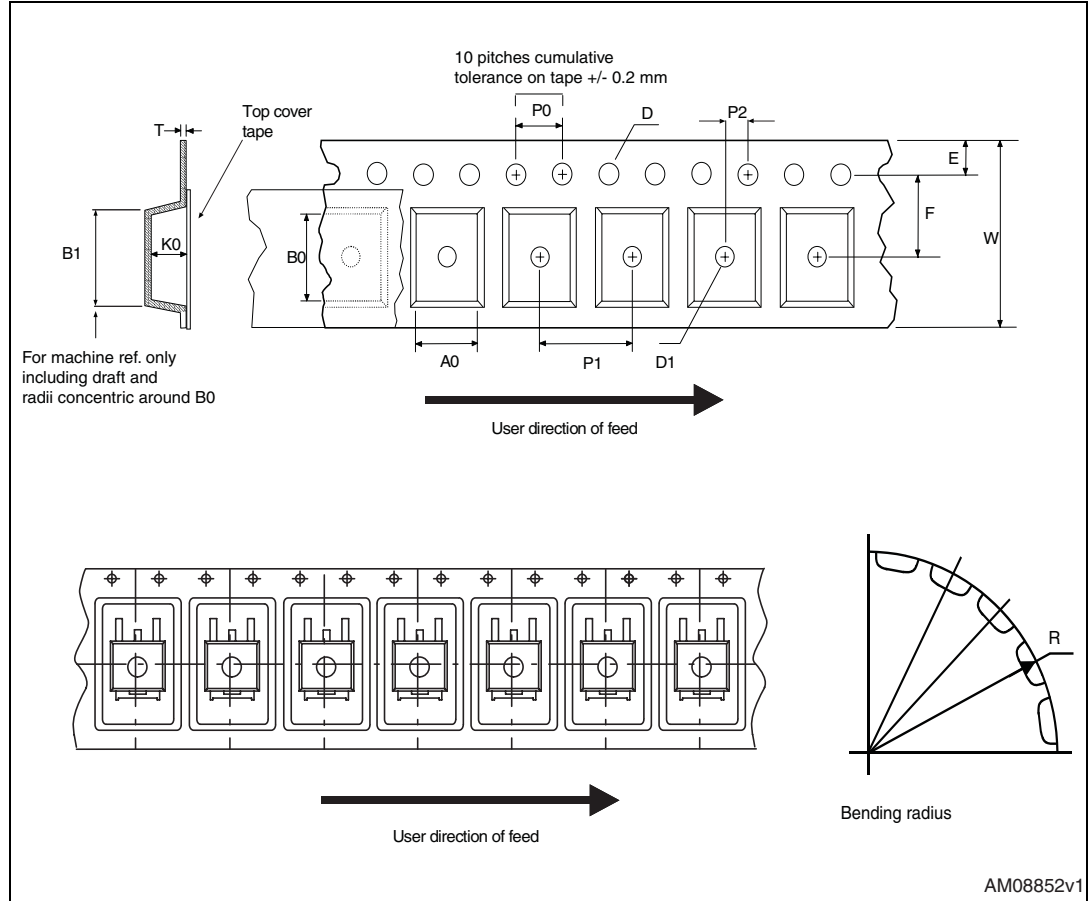


a. All dimension are in millimeters

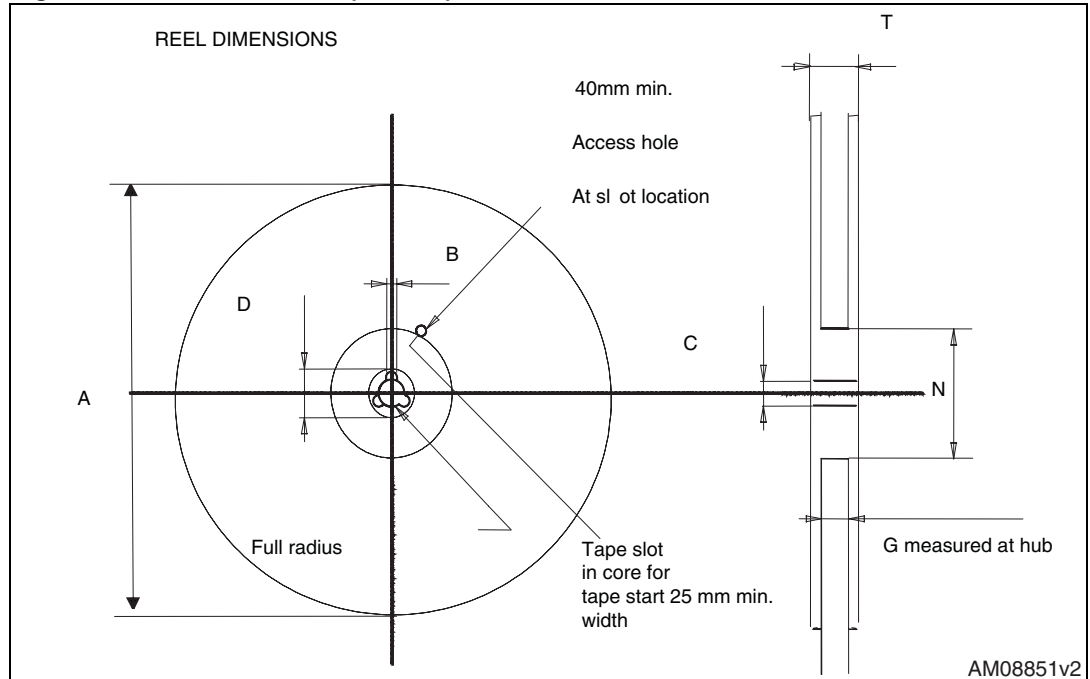
**STD96N3LLH6**

**Packaging mechanical data**

**Figure 21. Tape for DPAK (TO-252)**



**Figure 22. Reel for DPAK (TO-252)**



## 6 Revision history

Table 10. Document revision history

Date	Revision	Changes
27-Jan-2011	1	First release.

## STD96N3LLH6

---

### 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.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

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.

© 2011 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)