



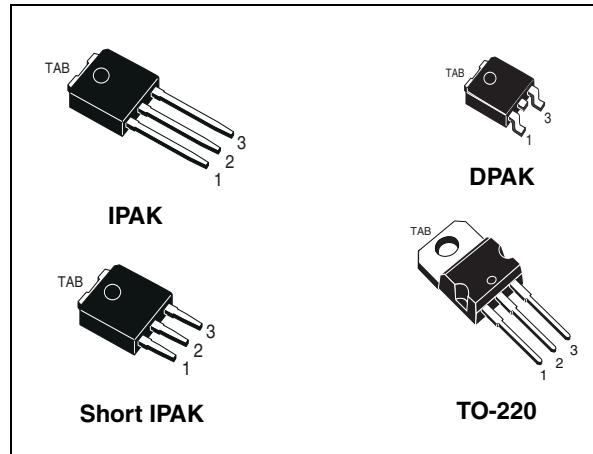
# STD75N3LLH6, STP75N3LLH6 STU75N3LLH6, STU75N3LLH6-S

N-channel 30 V, 0.0042  $\Omega$ , 75 A, DPAK, TO-220, IPAK, Short IPAK  
STripFET™ VI DeepGATE™ Power MOSFET

## Features

Order codes	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STD75N3LLH6	30 V	< 0.0055 $\Omega$	75 A
STP75N3LLH6		< 0.0059 $\Omega$	
STU75N3LLH6			
STU75N3LLH6-S			

- 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

## Description

This N-Channel Power MOSFET product 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

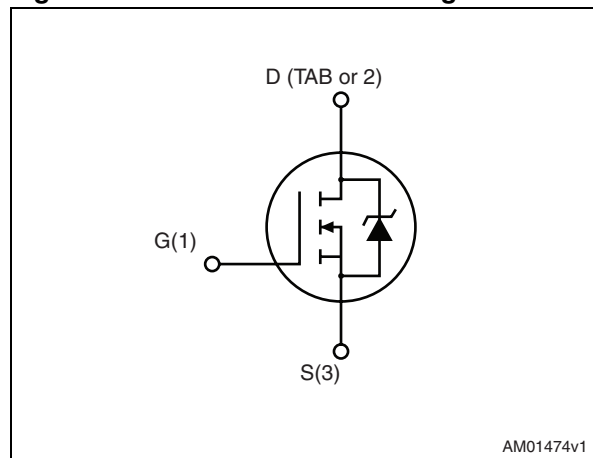


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD75N3LLH6	75N3LLH6	DPAK	Tape and reel
STP75N3LLH6		TO-220	Tube
STU75N3LLH6		IPAK	
STU75N3LLH6-S		Short IPAK	

# Contents

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# 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 $T_C = 25\text{ }^\circ\text{C}$	75	A
$I_D$	Drain current (continuous) at $T_C = 70\text{ }^\circ\text{C}$	56	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	47	A
$I_{DM}^{(2)}$	Drain current (pulsed)	300	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	60	W
	Derating factor	0.4	W/ $^\circ\text{C}$
$T_j$ $T_{stg}$	Operating junction temperature storage temperature	-55 to 175	$^\circ\text{C}$

1. The value is rated according to Rthj-case
2. Pulse width limited by safe operating area

**Table 3. Thermal data**

Symbol	Parameter	Value				Unit
		DKPAK	TO-220	IPAK	Short IPAK	
$R_{thj-case}$	Thermal resistance junction-case (drain) (steady state)	2.5				$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-amb max	100	62.5	100		$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	35				$^\circ\text{C}/\text{W}$
$T_J$	Maximum lead temperature for soldering purpose	275	300	275		$^\circ\text{C}$

1. When mounted on FR-4 board of 1in<sup>2</sup>, 2oz Cu. t < 10 sec

## 2 Electrical characteristics

( $T_{CASE}=25^{\circ}C$  unless otherwise specified)

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ( $V_{GS} = 0$ )	$I_D = 250 \mu A$	30			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 30 V$ $V_{DS} = 30 V T_C = 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20 V$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$	1	1.7	2.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10 V, I_D = 37.5 A$ SMD version		0.0042	0.0055	$\Omega$
		$V_{GS} = 10 V, I_D = 37.5 A$		0.0046	0.0059	$\Omega$
		$V_{GS} = 4.5 V, I_D = 37.5 A$ SMD version		0.0065	0.008	$\Omega$
		$V_{GS} = 4.5 V, I_D = 37.5 A$		0.0069	0.0084	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25 V, f = 1 MHz,$ $V_{GS} = 0$	1350	1690	2030	pF
$C_{oss}$	Output capacitance		230	290	350	pF
$C_{rss}$	Reverse transfer capacitance		140	176	210	pF
$Q_g$	Total gate charge	$V_{DD} = 15 V, I_D = 75 A,$ $V_{GS} = 4.5 V$ (see <a href="#">Figure 14</a> )		17	23.8	nC
$Q_{gs}$	Gate-source charge			8	11.2	nC
$Q_{gd}$	Gate-drain charge			6	8.4	nC
$Q_{gs1}$	Pre $V_{th}$ gate-to-source charge	$V_{DD} = 15 V, I_D = 75 A$ $V_{GS} = 5 V$ ( <a href="#">Figure 19</a> )		3.9	5.5	nC
$Q_{gs2}$	Post $V_{th}$ gate-to-source charge			4.1	5.7	nC
$R_G$	Gate input resistance	f=1 MHz gate bias Bias=0 test signal level=20 mV open drain	1.25	1.7	2	$\Omega$

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 15\text{ V}$ , $I_D = 37.5\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 5\text{ V}$ (see <a href="#">Figure 13</a> )	-	9.5	-	ns
$t_r$	Rise time			30		ns
$t_{d(off)}$	Turn-off delay time			37		ns
$t_f$	Fall time			12		ns

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		75	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				300	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 37.5\text{ A}$ , $V_{GS} = 0$	-		1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 75\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 24\text{ V}$ (see <a href="#">Figure 15</a> )	-	24		ns
$Q_{rr}$	Reverse recovery charge			16.8		nC
$I_{RRM}$	Reverse recovery current			1.4		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

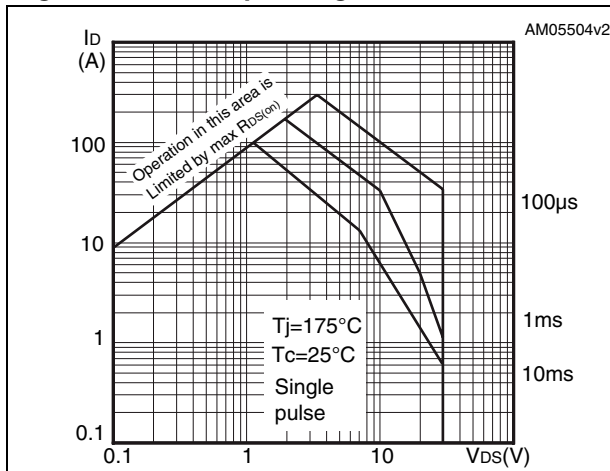


Figure 3. Thermal impedance

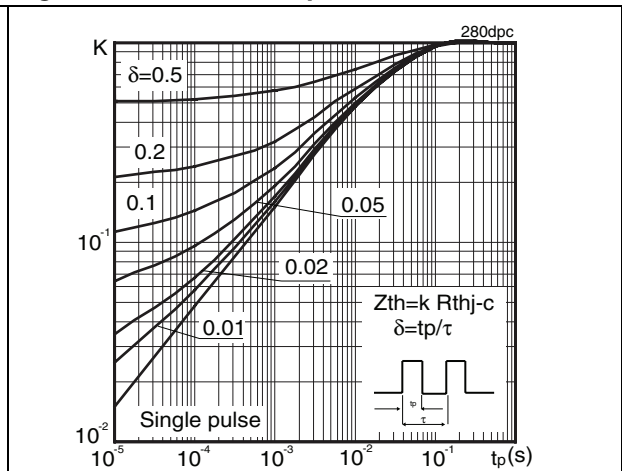


Figure 4. Output characteristics

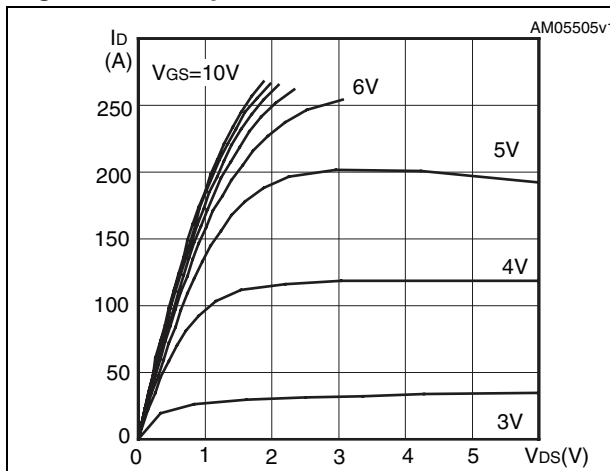


Figure 5. Transfer characteristics

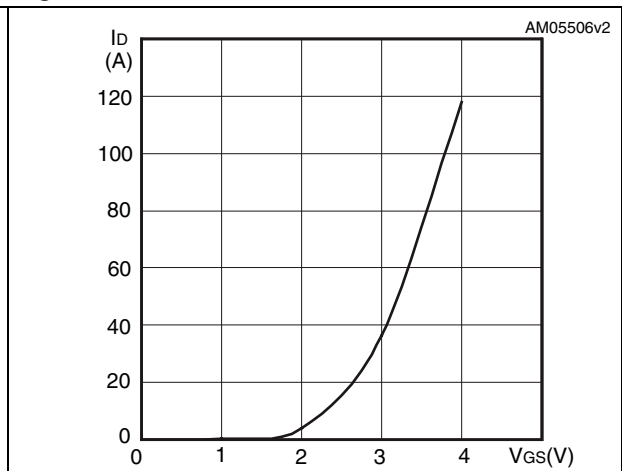


Figure 6. Normalized  $BV_{DSS}$  vs temperature

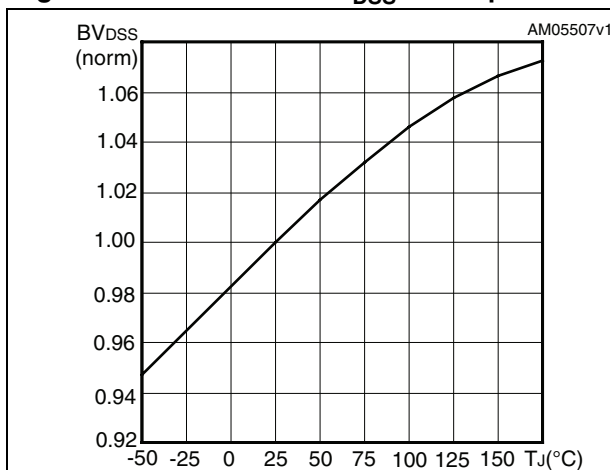


Figure 7. Static drain-source on resistance

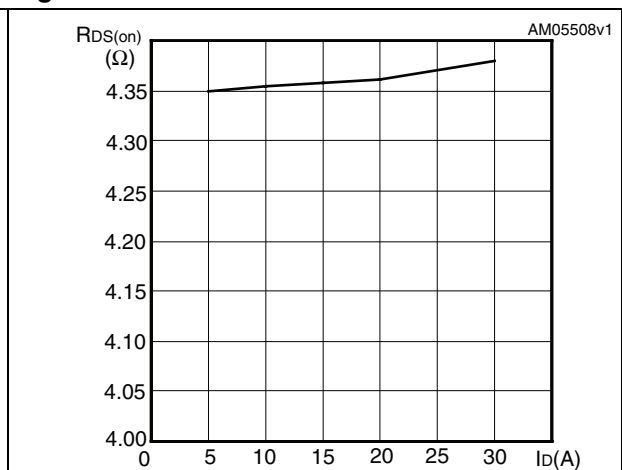


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

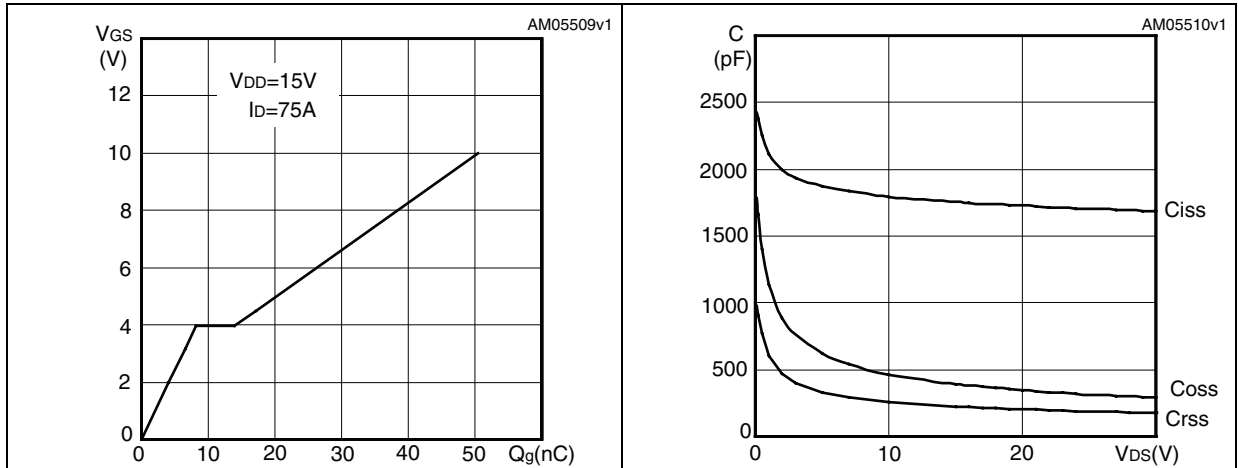


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

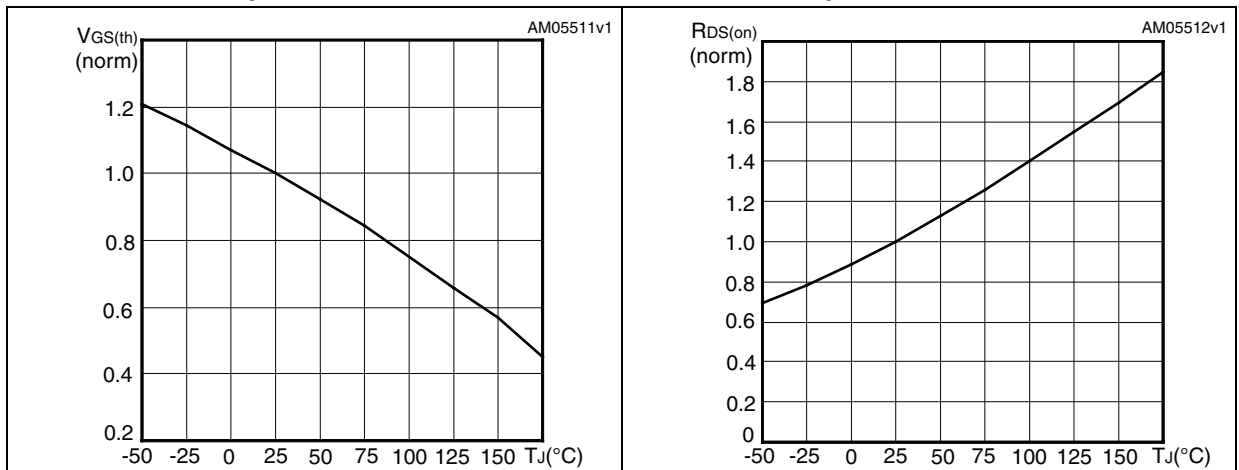
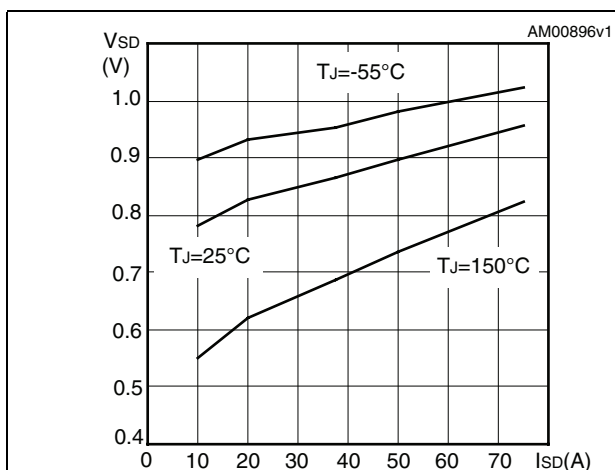
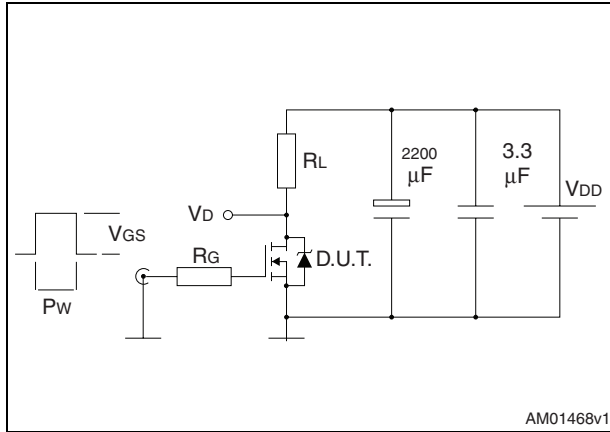


Figure 12. Source-drain diode forward characteristics



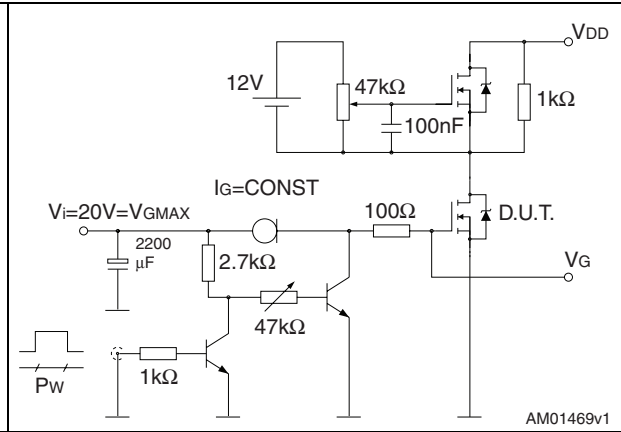
### 3 Test circuits

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



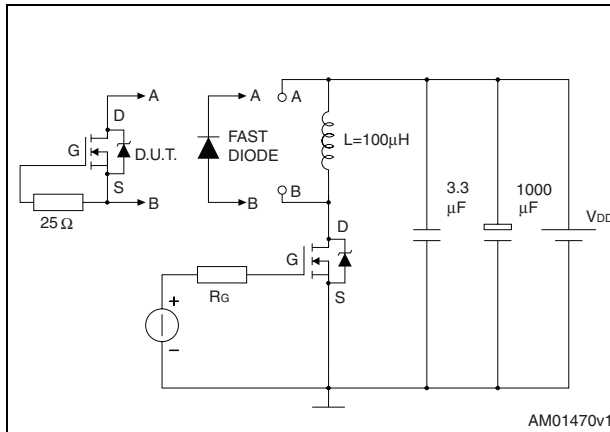
AM01468v1

**Figure 14. Gate charge test circuit**



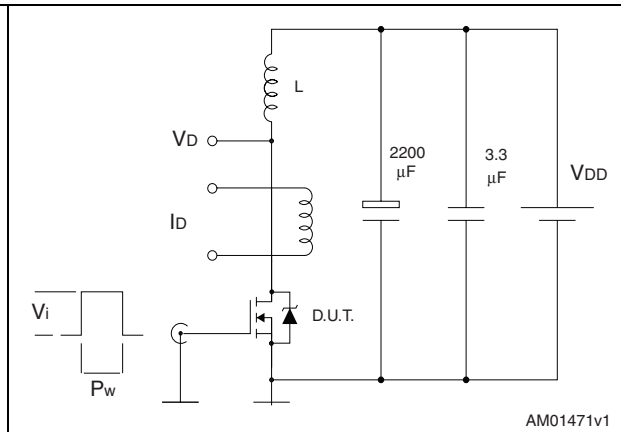
AM01469v1

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



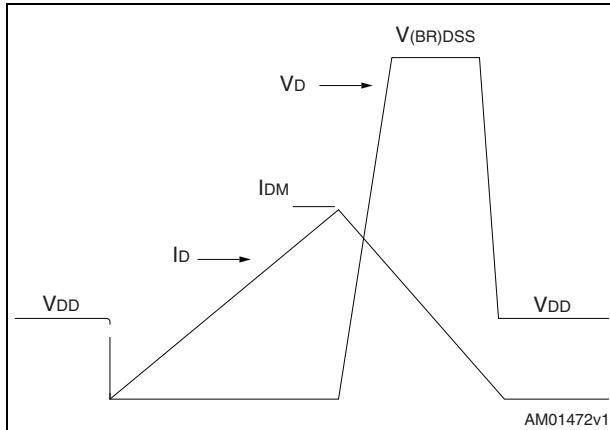
AM01470v1

**Figure 16. Unclamped inductive load test circuit**



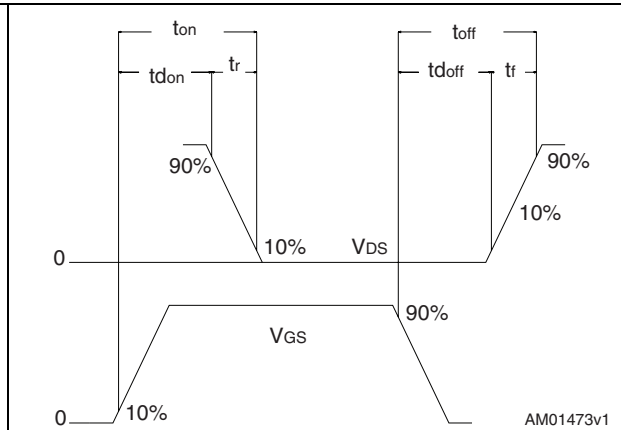
AM01471v1

**Figure 17. Unclamped inductive waveform**



AM01472v1

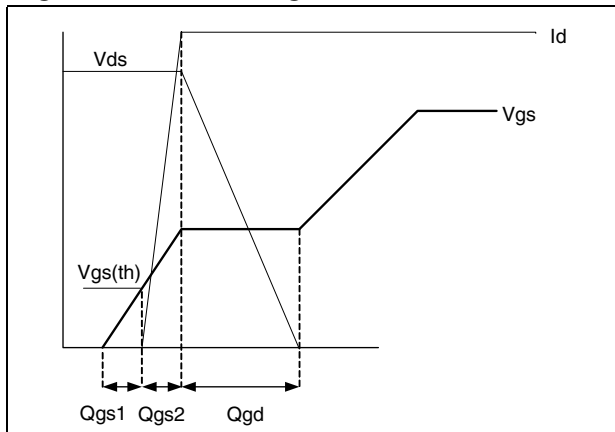
**Figure 18. Switching time waveform**



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® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

Table 8. Short IPAK mechanical dimensions

Dim.	mm		
	Min	Typ	Max
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.25	
e1	4.40		4.60
H	9.80		10.40
L	3.00		3.40
L1	0.80		1.20
L2		0.80	1.00

Figure 20. Short IPAK mechanical drawing

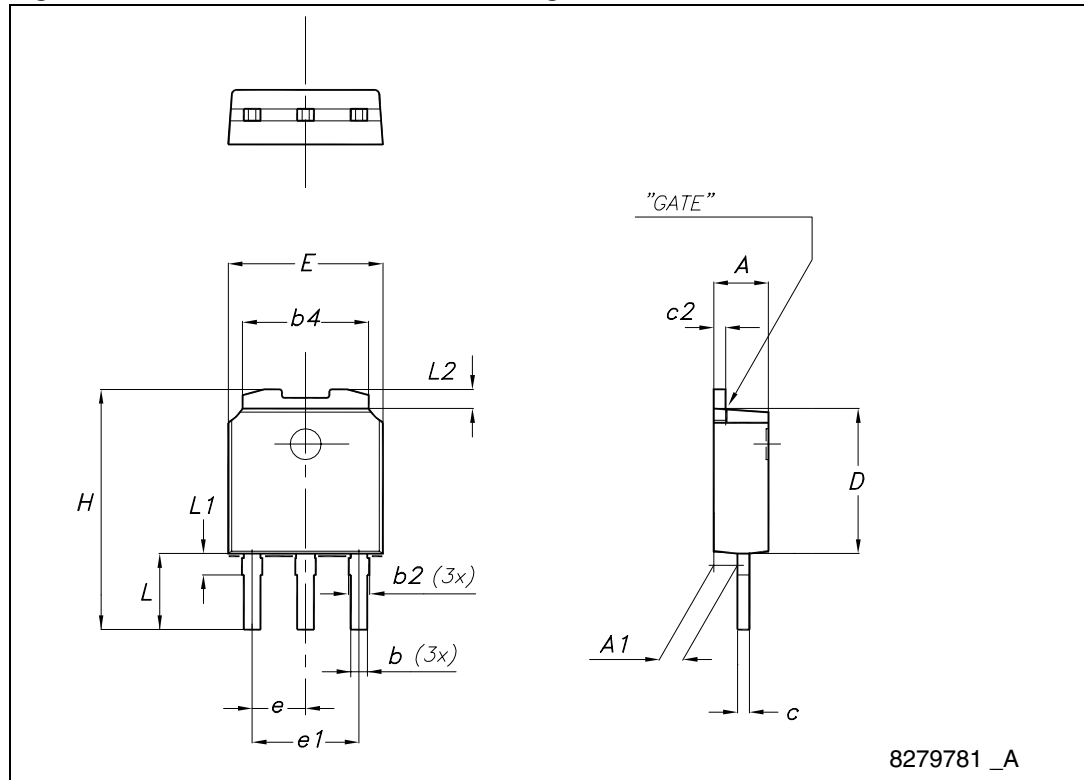
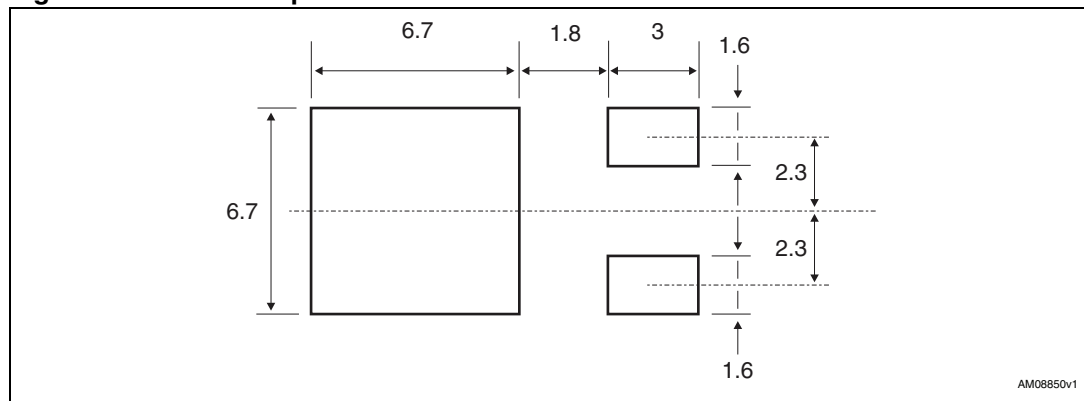


Table 9. DPAK (TO-252) mechanical data

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		1.50
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°

Figure 21. DPAK footprint<sup>(a)</sup>



a. All dimension are in millimeters

Figure 22. DPAK (TO-252) drawing

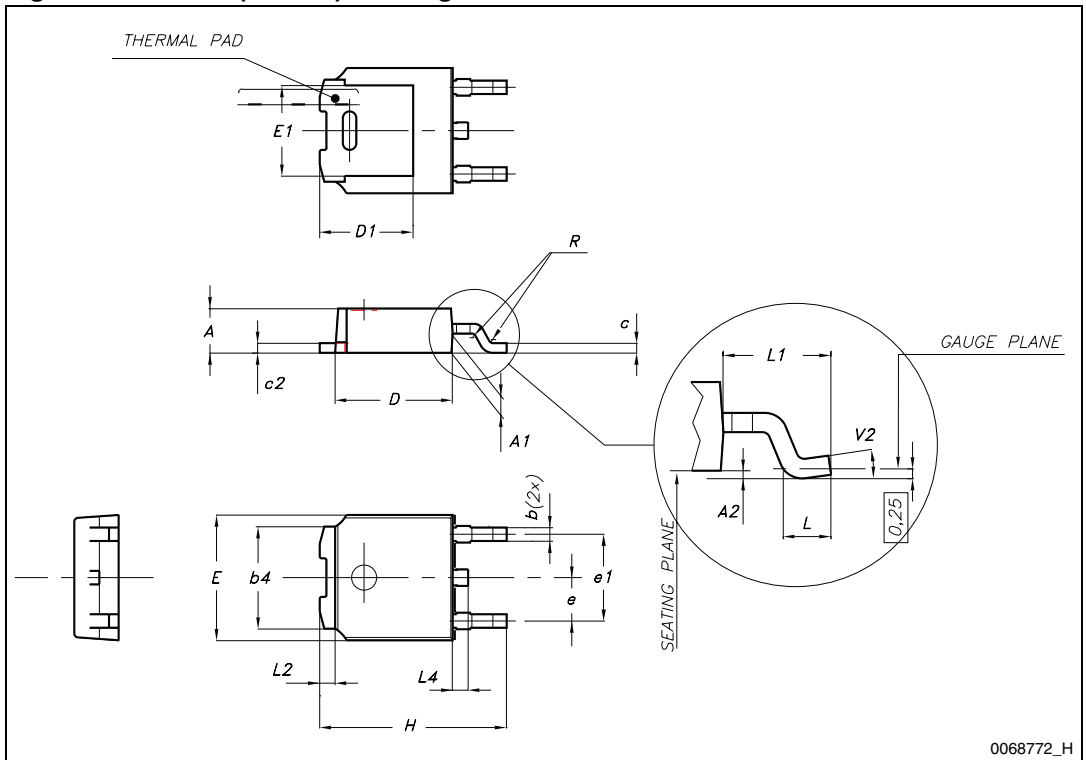


Table 10. IPAK (TO-251) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
B5		0.3	
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
L1	0.80		1.20
L2		0.80	1.00
V1		10 °	

Figure 23. IPAK (TO-251) drawing

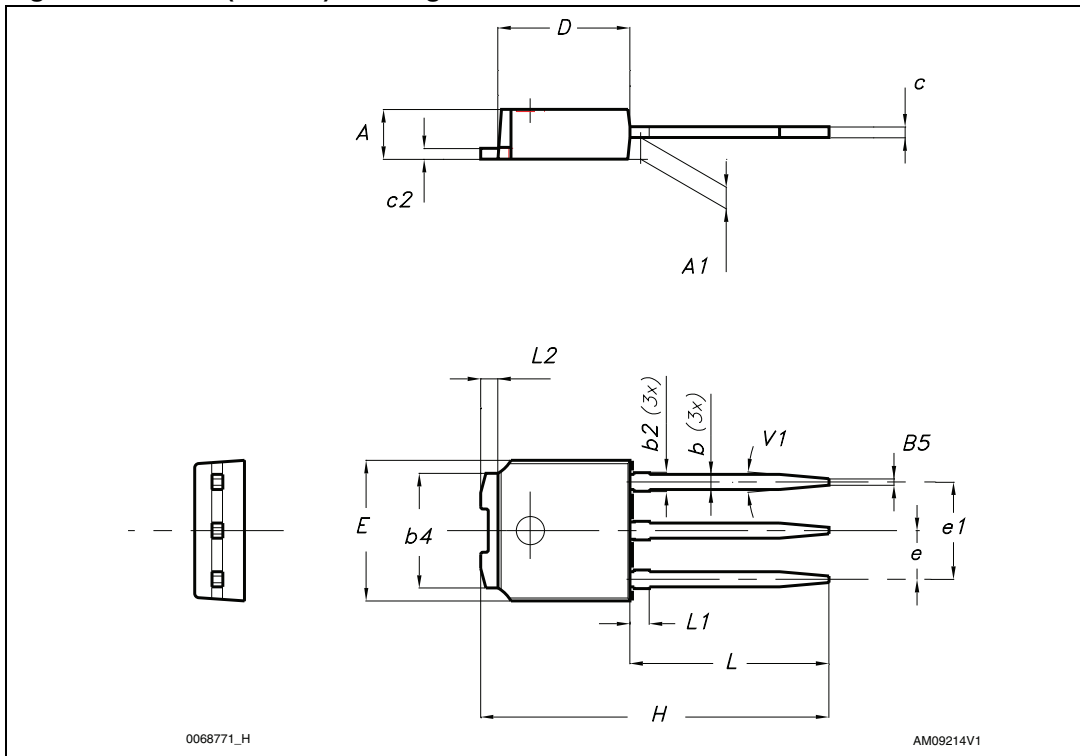
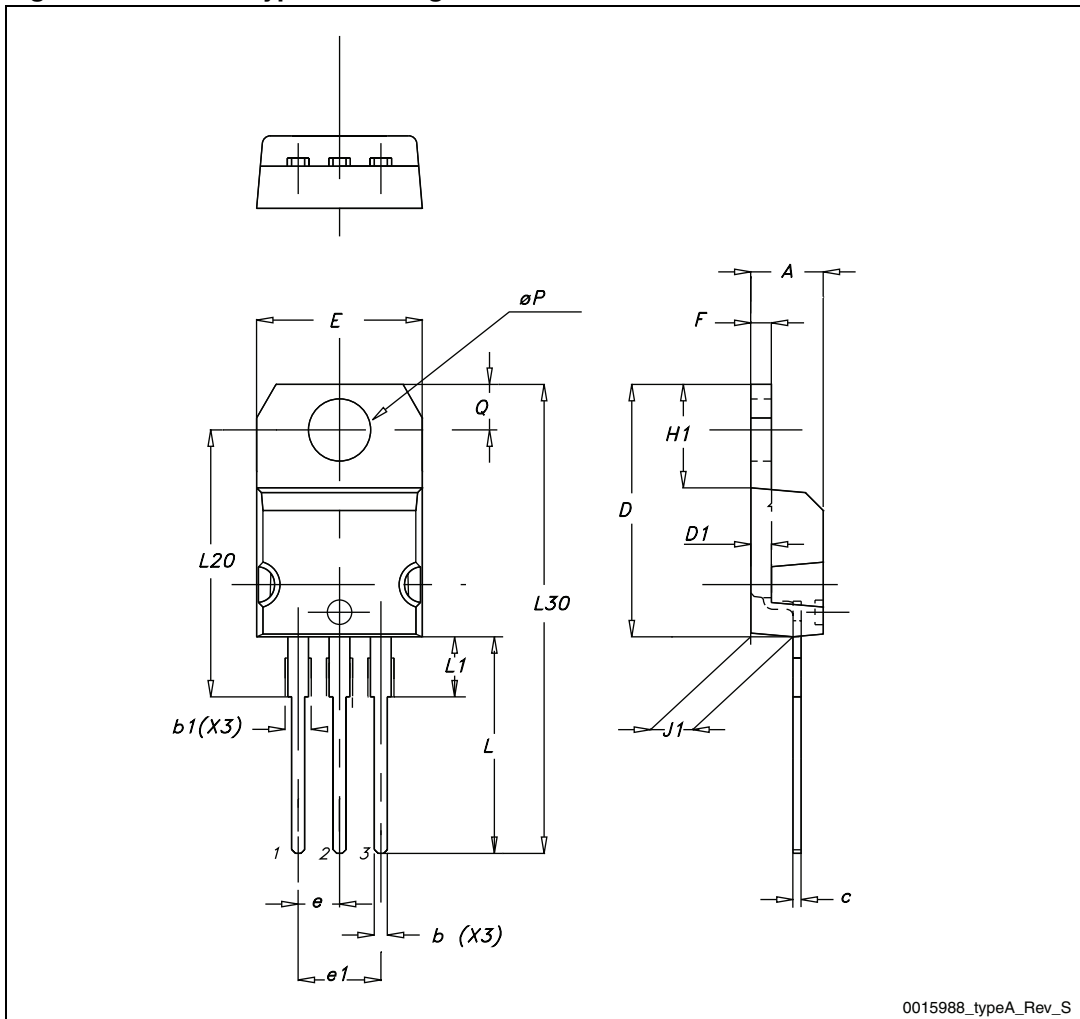


Table 11. TO-220 type A mechanical data

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	
∅P	3.75		3.85
Q	2.65		2.95



Figure 24. TO-220 type A drawing



## 5 Packaging mechanical data

Table 12. 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 25. Tape for DPAK (TO-252)

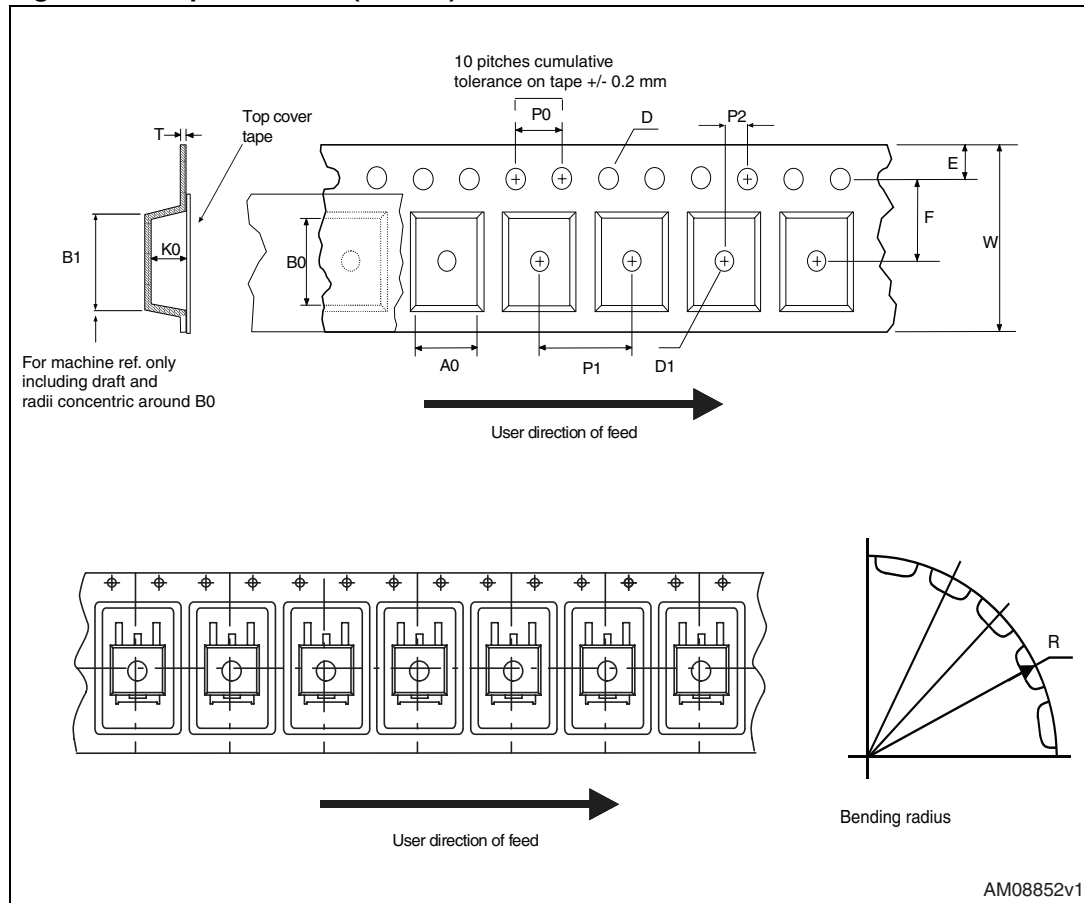
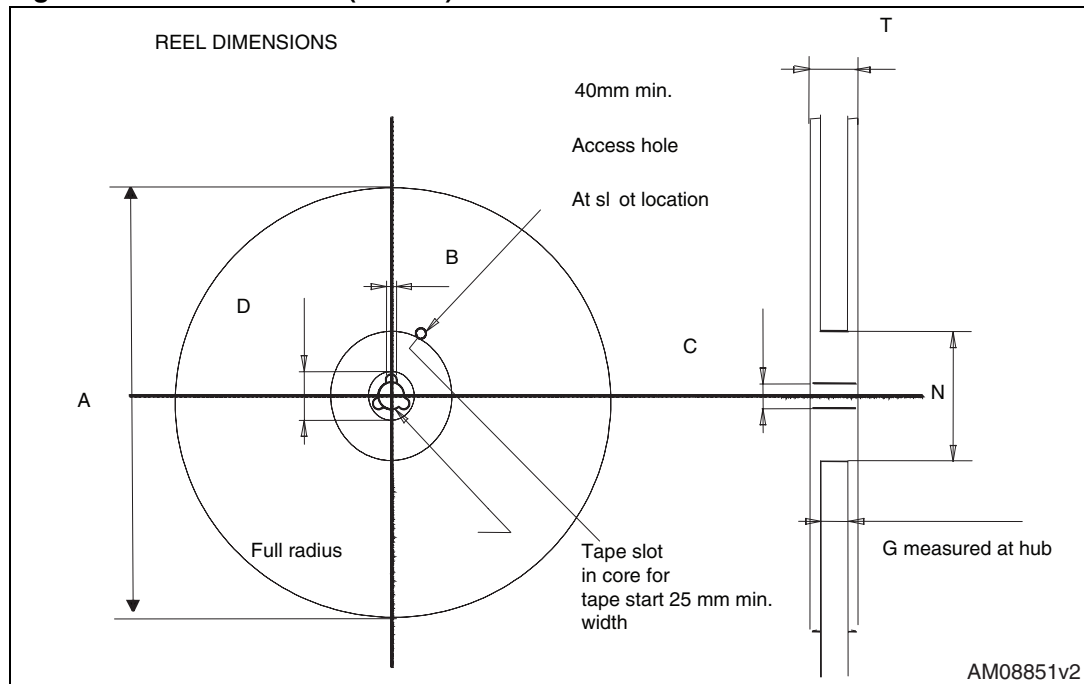


Figure 26. Reel for DPAK (TO-252)



## 6 Revision history

**Table 13. Document revision history**

Date	Revision	Changes
01-Jul-2009	1	First issue.
02-Oct-2009	2	<ul style="list-style-type: none"><li>– Added device in Short IPAK.</li><li>– Document status promoted from preliminary data to datasheet.</li></ul>
19-Apr-2011	3	<ul style="list-style-type: none"><li>– Added max values in <a href="#">Table 5: Dynamic</a>.</li><li>– Added new package and mechanical data.</li><li>– Inserted new <math>I_D</math> value @ 70 °C (see <a href="#">Table 2: Absolute maximum ratings</a>)</li></ul>
04-Jul-2011	4	Updated: mechanical data

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