



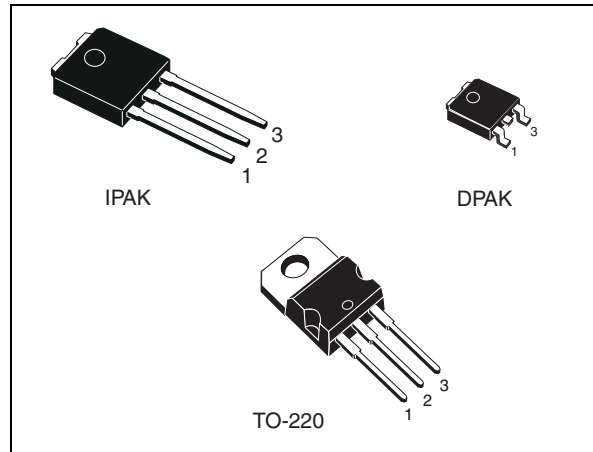
# STD27N3LH5, STP27N3LH5 STU27N3LH5

N-channel 30 V, 0.014  $\Omega$ , 27 A, DPAK, IPAK, TO-220  
STripFET™ V Power MOSFET

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STD27N3LH5	30 V	0.019 $\Omega$	27 A
STP27N3LH5	30 V	0.020 $\Omega$	27 A
STU27N3LH5	30 V	0.020 $\Omega$	27 A

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



## Application

- Switching applications

## Description

This STripFET™V Power MOSFET technology is among the latest improvements, which have been especially tailored to achieve very low on-state resistance providing also one of the best-in-class figure of merit (FOM).

Figure 1. Internal schematic diagram

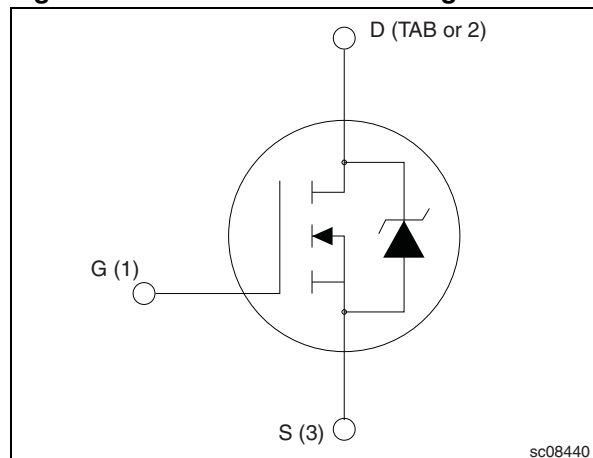


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD27N3LH5	27N3LH5	DPAK	Tape and reel
STU27N3LH5	27N3LH5	IPAK	Tube
STP27N3LH5	27N3LH5	TO-220	Tube

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		DPAK, IPAK	TO-220	
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	30		V
$V_{GS}$	Gate-Source voltage	$\pm 22$		V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	27		A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	19		A
$I_{DM}^{(2)}$	Drain current (pulsed)	108		A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	30	45	W
	Derating factor	0.2		W/ $^\circ\text{C}$
$E_{AS}^{(3)}$	Single pulse avalanche energy	50		mJ
$T_J$ $T_{stg}$	Operating junction temperature Storage temperature	- 55 to 175		$^\circ\text{C}$

1. Limited by wire bonding
2. Pulse width limited by safe operating area
3. Starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $I_D = 21\text{ A}$ ,  $L = 0.2\text{ mH}$

**Table 3. Thermal resistance**

Symbol	Parameter	Value		Unit
		DPAK, IPAK	TO-220	
$R_{thJC}$	Thermal resistance junction-case max	5	3.33	$^\circ\text{C}/\text{W}$
$R_{thJA}$	Thermal resistance junction-case max	100		$^\circ\text{C}/\text{W}$
$T_J$	Maximum lead temperature for soldering purpose	275		$^\circ\text{C}$

## 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	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$	30			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 30\text{ V}$ $V_{DS} = 30\text{ V}$ , $T_c = 125\text{ °C}$			1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 22\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	1		2.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$ , $I_D = 13.5\text{ A}$ SMD version		0.015 0.014	0.020 0.019	$\Omega$ $\Omega$
		$V_{GS} = 4.5\text{ V}$ , $I_D = 13.5\text{ A}$ SMD version		0.021 0.020	0.028 0.027	$\Omega$ $\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	475	-	pF
$C_{oss}$	Output capacitance			97		pF
$C_{rss}$	Reverse transfer capacitance			19		pF
$Q_g$	Total gate charge	$V_{DD} = 15\text{ V}$ , $I_D = 27\text{ A}$	-	4.6	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 5\text{ V}$		1.7		nC
$Q_{gd}$	Gate-drain charge	( <i>Figure 16</i> )		1.9		nC
$Q_{gs1}$	Pre $V_{th}$ gate-to-source charge	$V_{DD} = 15\text{ V}$ , $I_D = 27\text{ A}$	-	0.67	-	nC
$Q_{gs2}$	Post $V_{th}$ gate-to-source charge	$V_{GS} = 5\text{ V}$ ( <i>Figure 21</i> )		0.84		nC
$R_G$	Gate input resistance	$f = 1\text{ MHz}$ gate bias = 0 test signal level = 20 mV open drain	-	2.5	-	$\Omega$

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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on delay time Rise time	$V_{DD} = 15\text{ V}$ , $I_D = 13.5\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ <i>(Figure 15 and Figure 20)</i>	-	4 22	-	ns ns
$t_{d(off)}$ $t_f$	Turn-off delay time Fall time	$V_{DD} = 15\text{ V}$ , $I_D = 13.5\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ <i>(Figure 15 and Figure 20)</i>	-	13 2.8	-	ns ns

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}^{(1)}$	Source-drain current Source-drain current (pulsed)		-		27 108	A A
$V_{SD}$	Forward on voltage	$I_{SD} = 13.5\text{ A}$ , $V_{GS} = 0$	-		1.1	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 27\text{ A}$ , $di/dt = 100$ $\text{A}/\mu\text{s}$ , $V_{DD} = 25\text{ V}$ <i>(Figure 17)</i>	-	16.2 7.8 1		ns nC A

1. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220

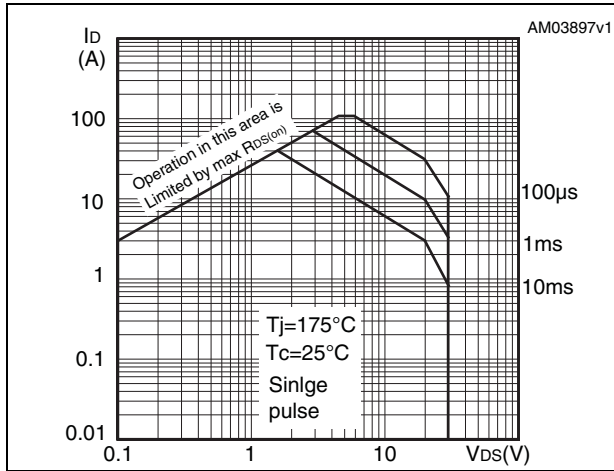


Figure 3. Thermal impedance for TO-220

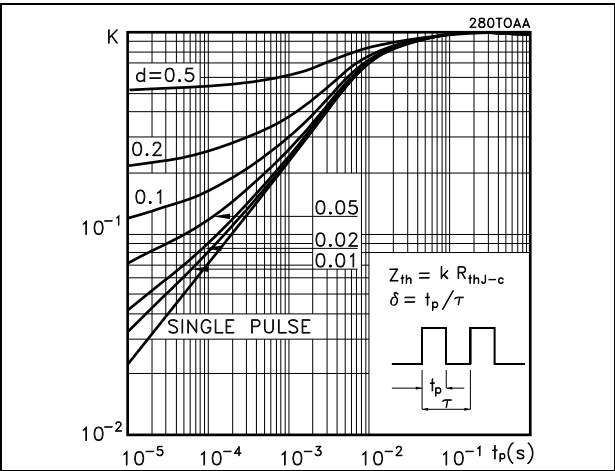


Figure 4. Safe operating area for DPAK, IPAK

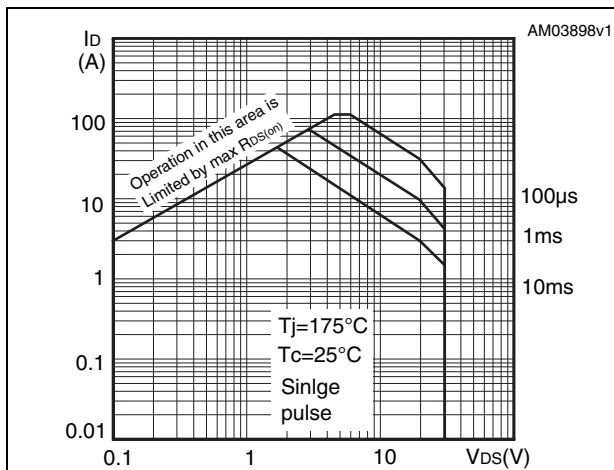


Figure 5. Thermal impedance for DPAK, IPAK

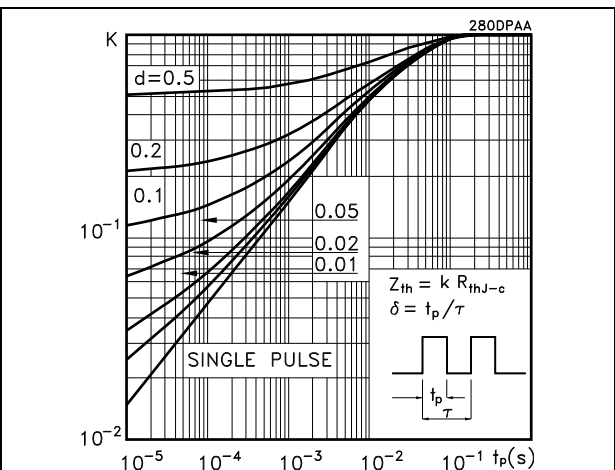


Figure 6. Output characteristics

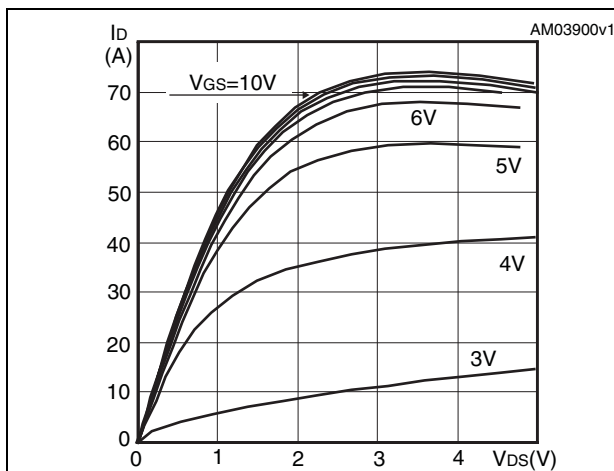


Figure 7. Transfer characteristics

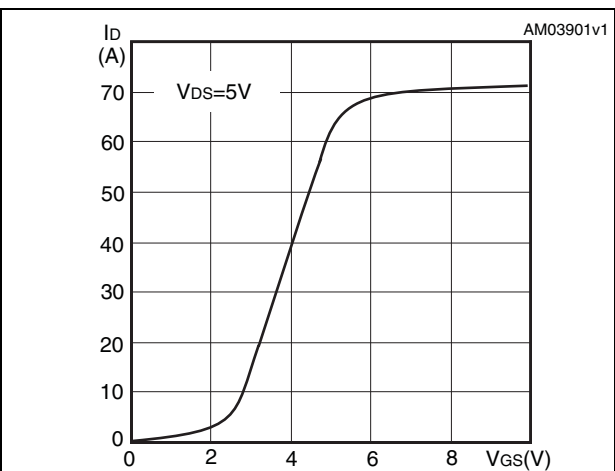


Figure 8. Normalized  $BV_{DSS}$  vs temperature      Figure 9. Static drain-source on resistance

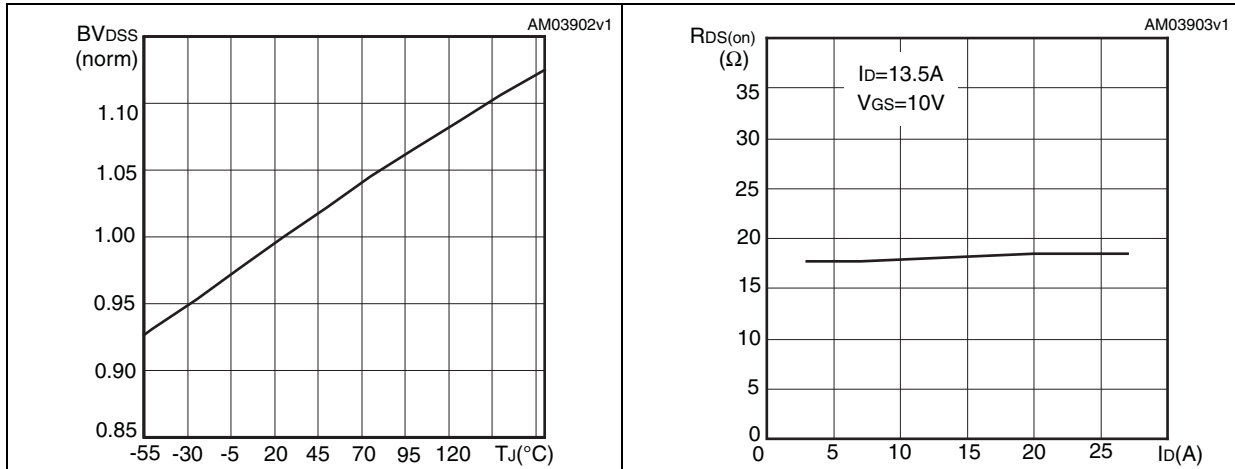


Figure 10. Gate charge vs gate-source voltage      Figure 11. Capacitance variations

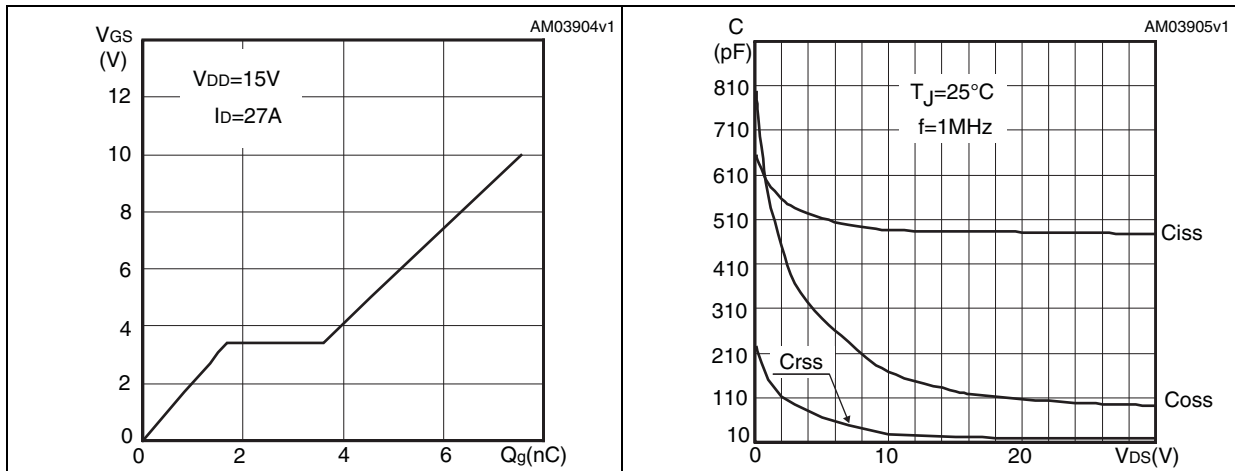


Figure 12. Normalized gate threshold voltage vs temperature      Figure 13. Normalized on resistance vs temperature

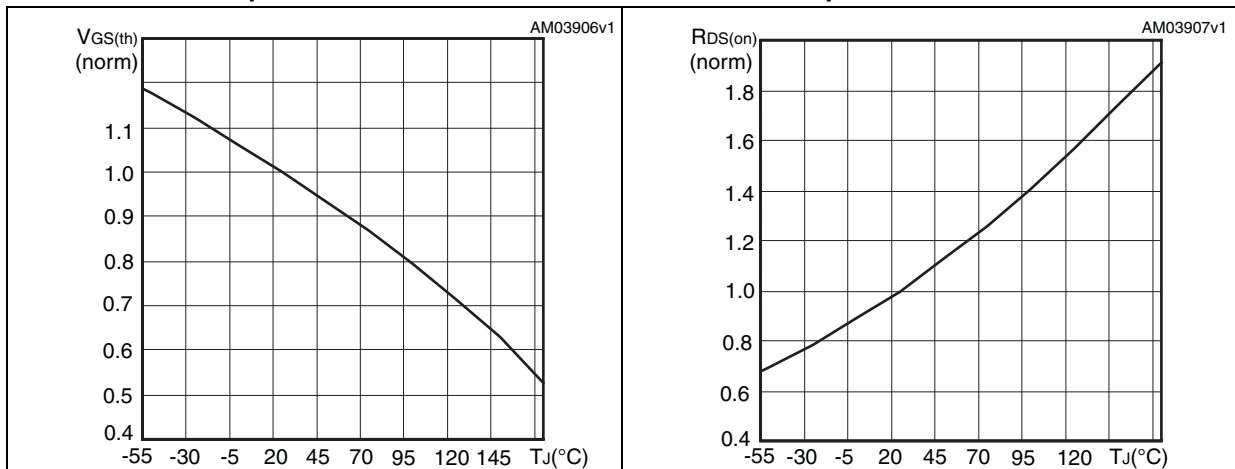
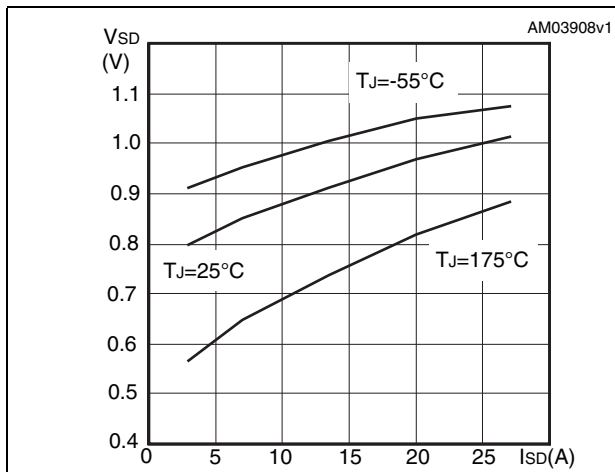


Figure 14. Source-drain diode forward characteristics





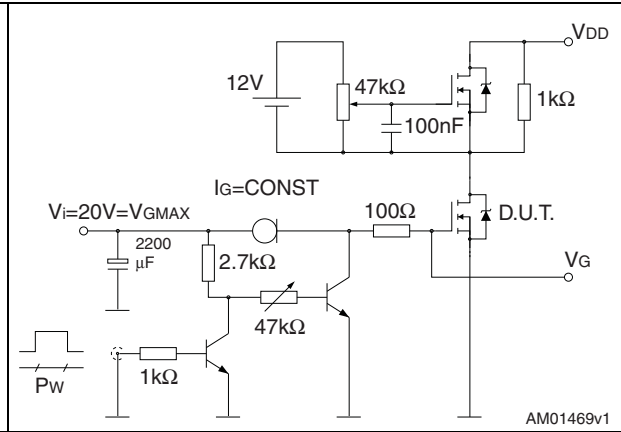
### 3 Test circuits

**Figure 15. Switching times test circuit for resistive load**



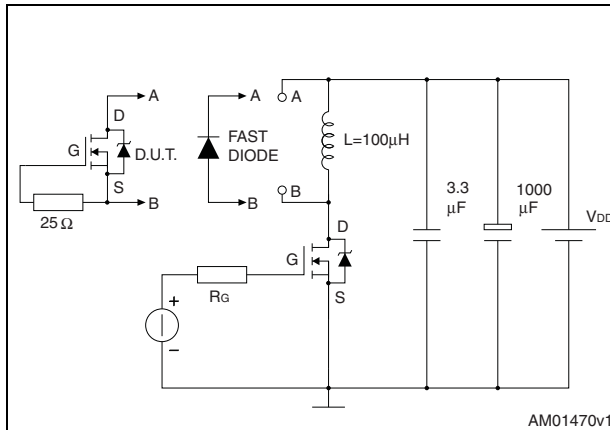
AM01468v1

**Figure 16. Gate charge test circuit**



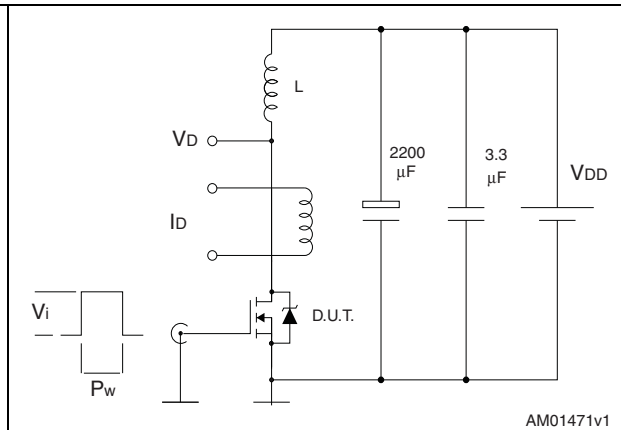
AM01469v1

**Figure 17. Test circuit for inductive load switching and diode recovery times**



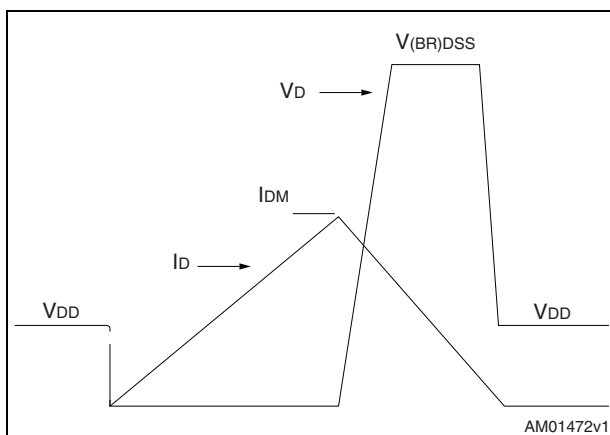
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**Figure 18. Unclamped inductive load test circuit**



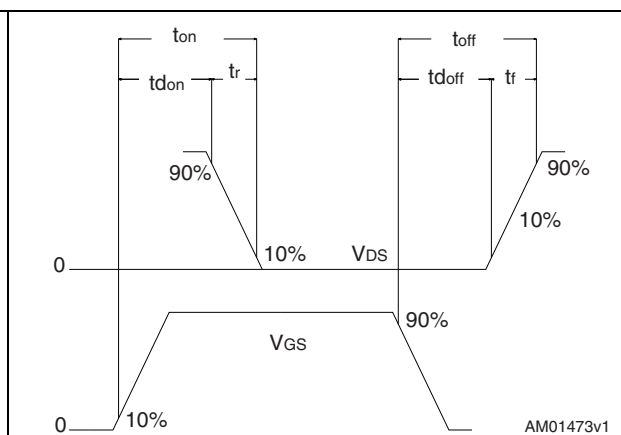
AM01471v1

**Figure 19. Unclamped inductive waveform**



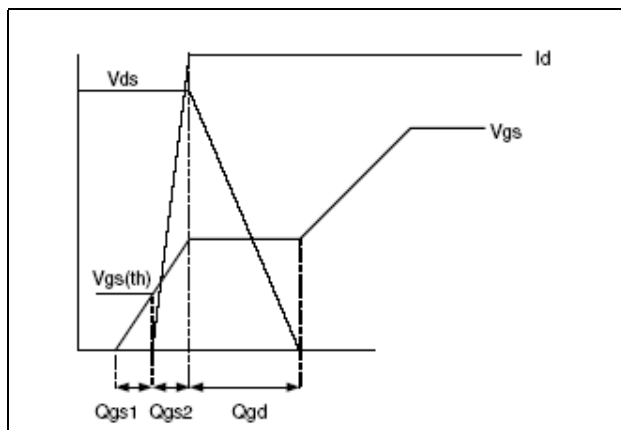
AM01472v1

**Figure 20. Switching time waveform**



AM01473v1

Figure 21. 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. 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°

Figure 22. DPAK (TO-252) drawing

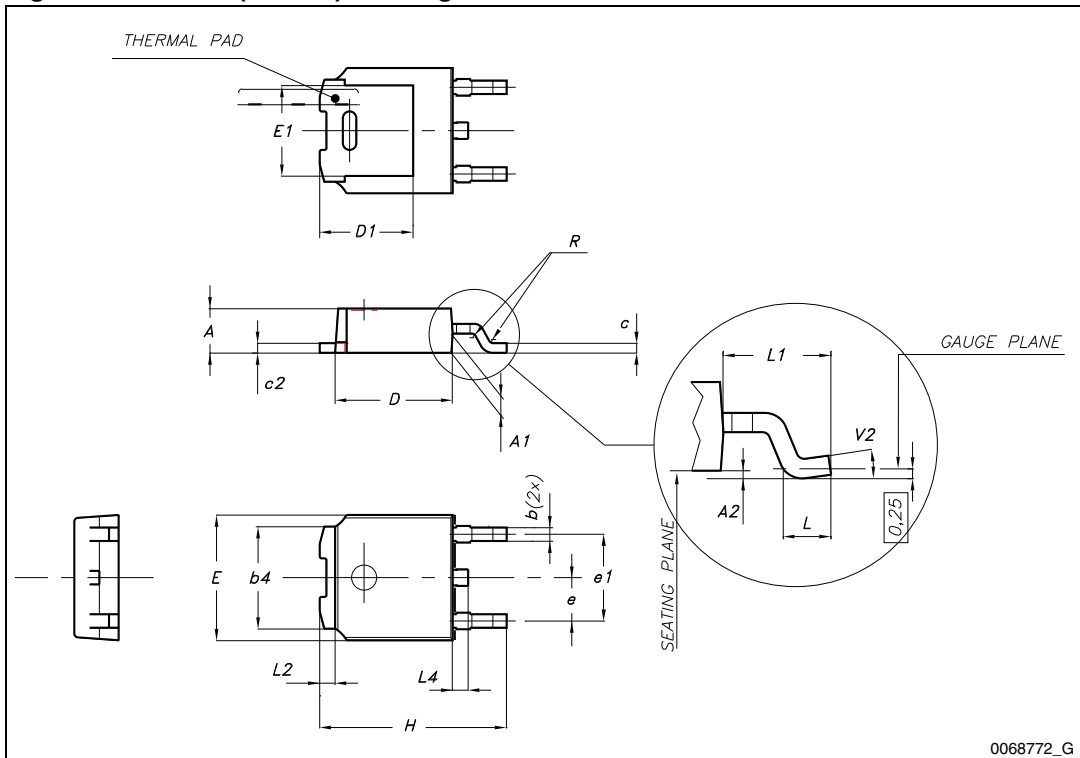
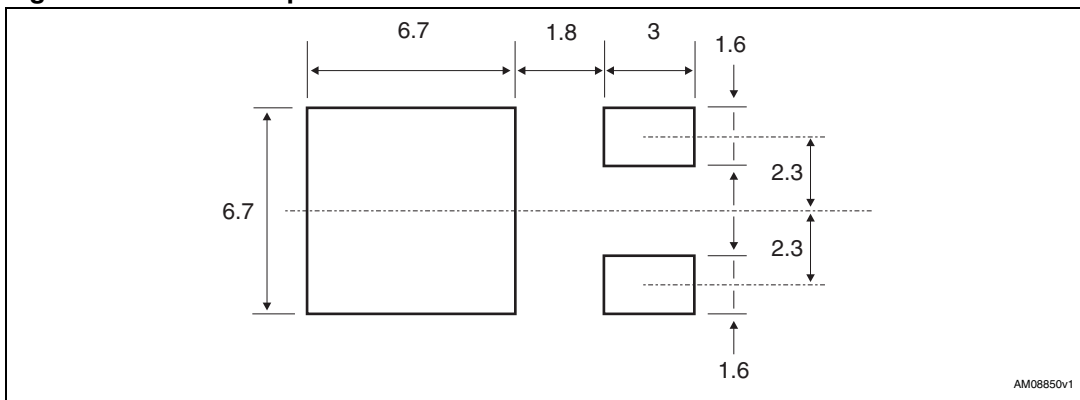


Figure 23. DPAK footprint<sup>(a)</sup>



a. All dimension are in millimeters

Table 9. 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 24. IPAK (TO-251) drawing

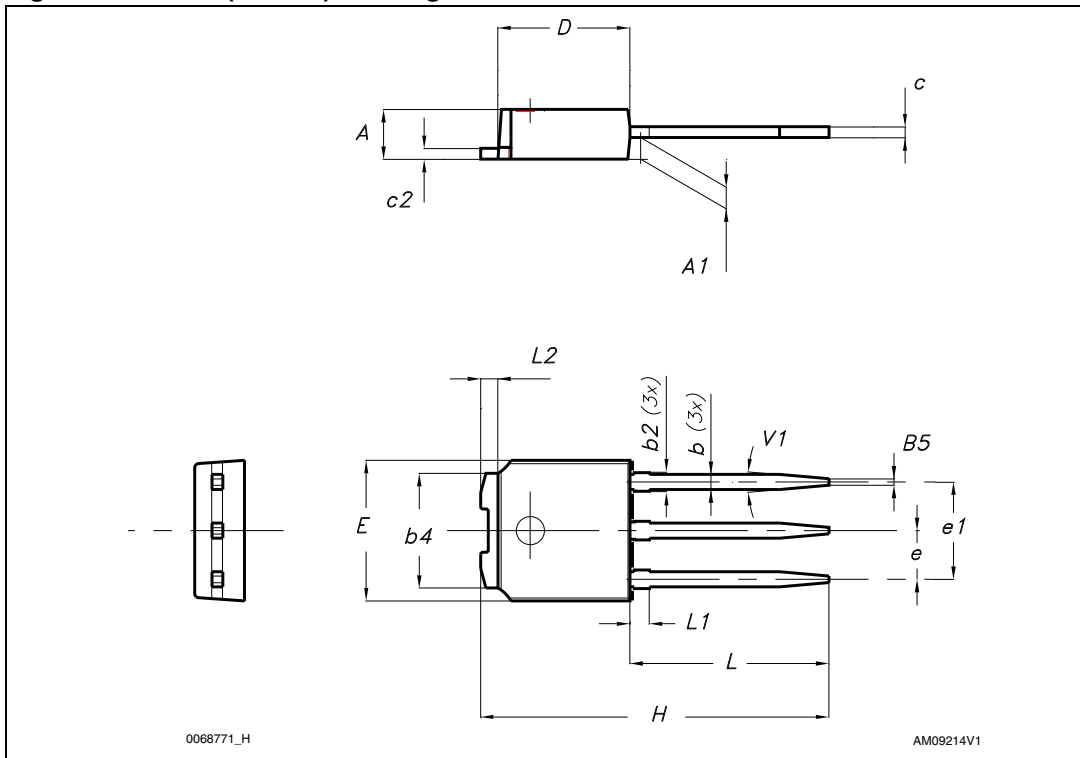
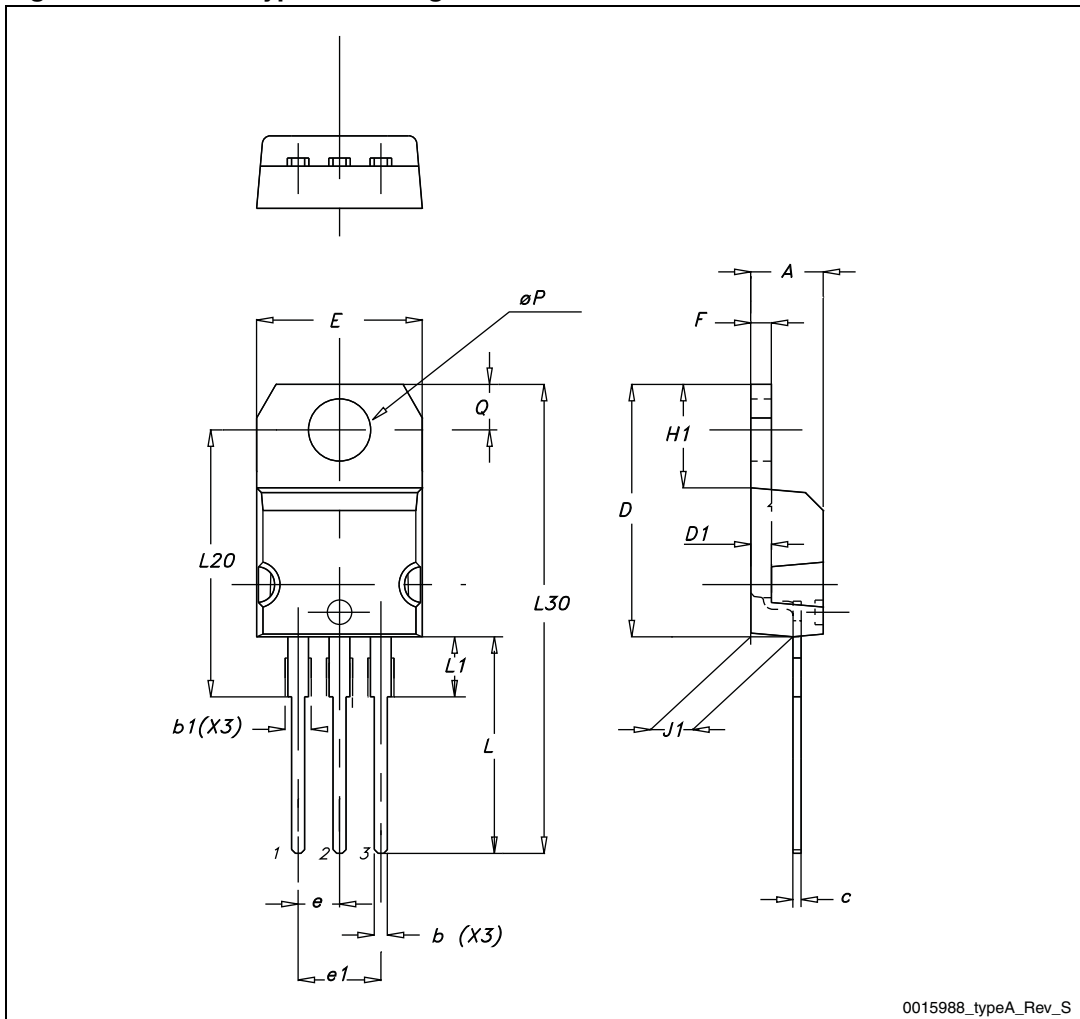


Table 10. TO-220 type A mechanical data

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



Figure 25. TO-220 type A drawing



0015988\_typeA\_Rev\_S

## 5 Packaging mechanical data

Table 11. 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 26. Tape for DPAK (TO-252)

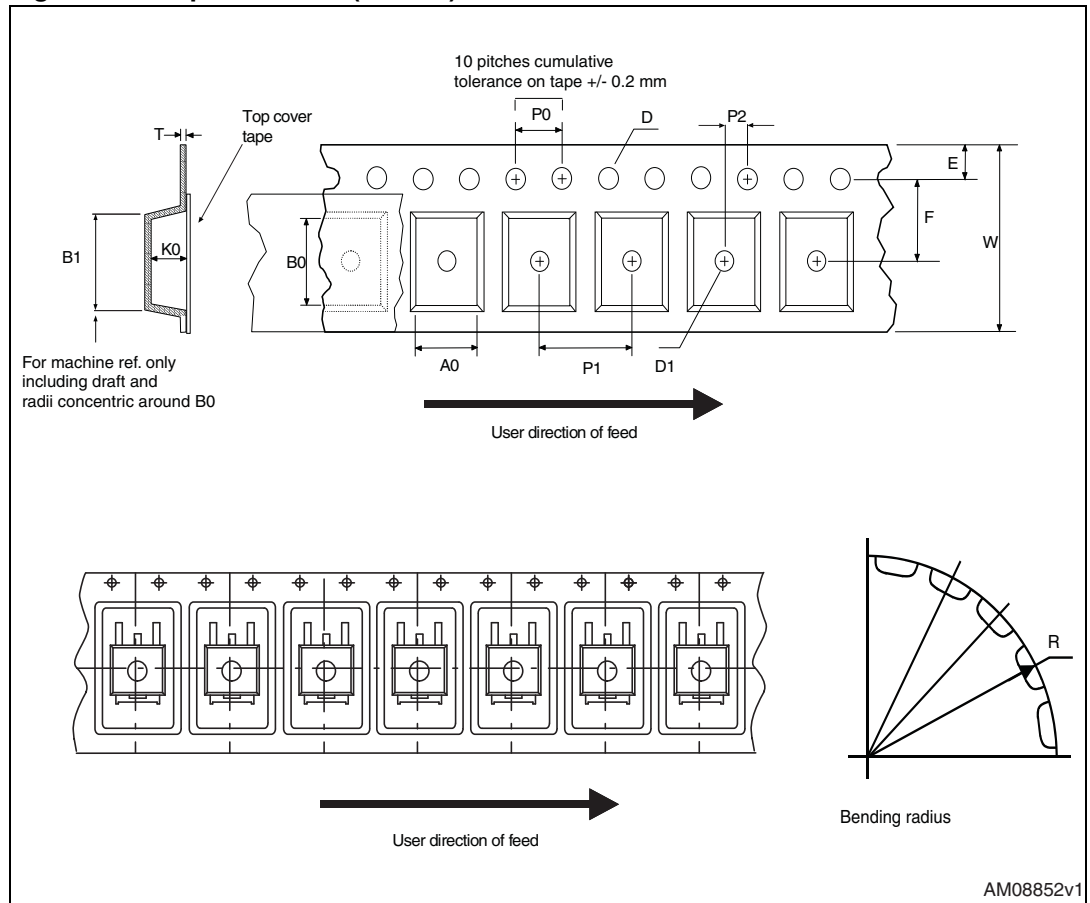
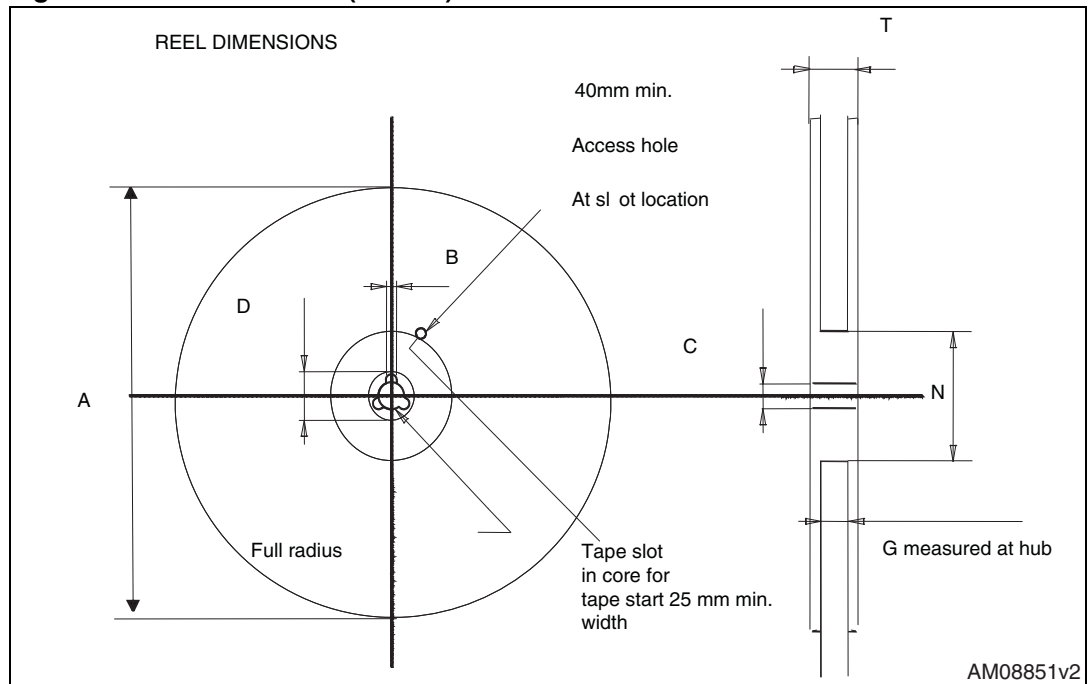


Figure 27. Reel for DPAK (TO-252)



## 6 Revision history

**Table 12. Document revision history**

Date	Revision	Changes
06-May-2009	1	First release
25-May-2009	2	Updated test condition for $Q_g$ in <a href="#">Table 5: Dynamic</a>
07-Mar-2011	3	$V_{GS(th)}$ max. value has been inserted in <a href="#">Table 4: Static</a>

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