



勝特力材料 886-3-5753170  
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# STB80N20M5 STP80N20M5

N-channel 200 V, 0.019  $\Omega$ , 61 A, TO-220, D<sup>2</sup>PAK  
MDmesh™ V Power MOSFET

## Features

Type	V <sub>DSS</sub> @ T <sub>Jmax</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STB80N20M5	200 V	< 0.023 $\Omega$	61 A
STP80N20M5			61 A

- Amongst the best R<sub>DS(on)</sub> \* area
- High dv/dt capability
- Excellent switching performance
- Easy to drive
- 100% avalanche tested

## Application

Switching applications

## Description

The devices are N-channel MDmesh™ V Power MOSFET based on an innovative proprietary vertical process technology, which is combined with STMicroelectronics' well-known PowerMESH™ horizontal layout structure. The resulting product has extremely low on-resistance, which is unmatched among silicon-based Power MOSFETs, making it especially suitable for applications which require superior power density and outstanding efficiency.

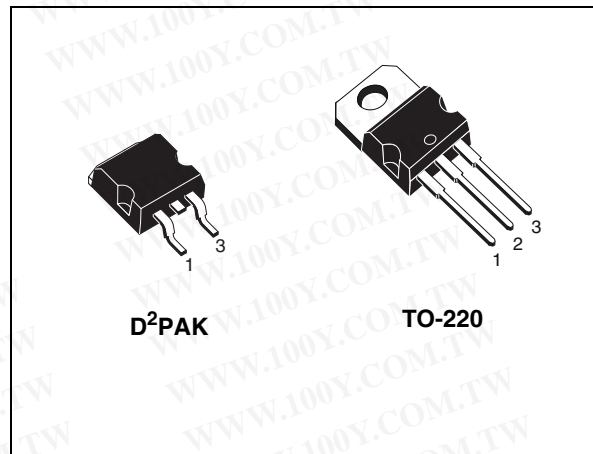


Figure 1. Internal schematic diagram

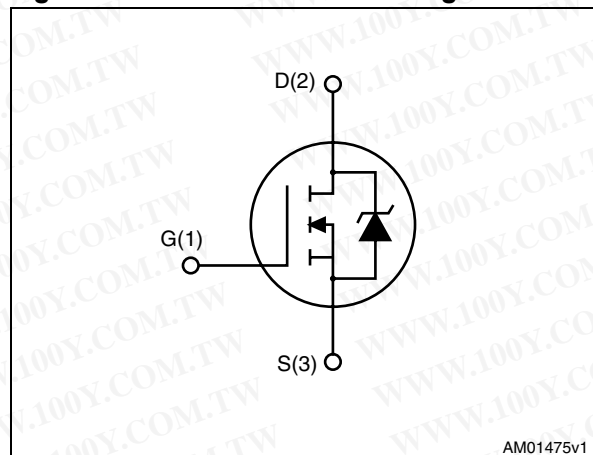


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB80N20M5	80N20M5	D <sup>2</sup> PAK	Tape and reel
STP80N20M5	80N20M5	TO-220	Tube

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
$V_{GS}$	Gate-source voltage	± 25		V
$I_D$	Drain current (continuous) at $T_C = 25\text{ °C}$	61		A
$I_D$	Drain current (continuous) at $T_C = 100\text{ °C}$	38		A
$I_{DM}^{(1)}$	Drain current (pulsed)	244		A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ °C}$	190		W
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ max)	20		A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ °C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	500		mJ
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15		V/ns
$T_{stg}$	Storage temperature	- 55 to 150		°C
$T_j$	Max. operating junction temperature	150		°C

1. Pulse width limited by safe operating area

2.  $I_{SD} \leq 61\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ;  $V_{Peak} < V_{(BR)DSS}$

**Table 3. Thermal data**

Symbol	Parameter	Value		Unit
		TO-220	D <sup>2</sup> PAK	
$R_{thj-case}$	Thermal resistance junction-case max	0.66		°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.50		°C/W
$R_{thj-pcb}$	Thermal resistance junction-pcb max		30	°C/W
$T_l$	Maximum lead temperature for soldering purpose	300		°C

## 2 Electrical characteristics

( $T_C = 25\text{ }^\circ\text{C}$  unless otherwise specified)

**Table 4. On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$ , $V_{GS} = 0$	200			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{max rating}$ $V_{DS} = \text{max rating}$ , $T_C = 125\text{ }^\circ\text{C}$			1 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 25\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$ , $I_D = 30.5\text{ A}$		0.019	0.023	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 50\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	4329	-	pF
$C_{oss}$	Output capacitance			275		
$C_{rss}$	Reverse transfer capacitance			39		
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{DS} = 0\text{ to }160\text{ V}$ , $V_{GS} = 0$	-	709	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related			280		
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	1.9	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 160\text{ V}$ , $I_D = 30.5\text{ A}$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15</a> )	-	104	-	nC
$Q_{gs}$	Gate-source charge			23		
$Q_{gd}$	Gate-drain charge			53		

1.  $C_{o(tr)}$  is a constant capacitance value that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .

2.  $C_{o(er)}$  is a constant capacitance value that gives the same stored energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(v)}$	Voltage delay time	$V_{DD} = 160\text{ V}$ , $I_D = 61\text{ A}$ ,		66		ns
$t_{r(v)}$	Voltage rise time	$R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$	-	31	-	ns
$t_{f(i)}$	Current fall time	(see <a href="#">Figure 16</a> )		131		ns
$t_{c(off)}$	Crossing time	(see <a href="#">Figure 19</a> )		176		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		61	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		244	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 61\text{ A}$ , $V_{GS} = 0$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 61\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$	-	176		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 60\text{ V}$ (see <a href="#">Figure 19</a> )	-	1.4		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			16		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 61\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$	-	218		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 60\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$	-	2		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	(see <a href="#">Figure 19</a> )		19		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

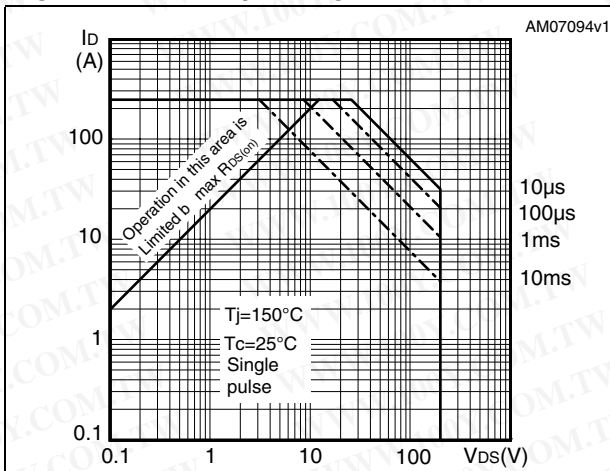


Figure 3. Thermal impedance

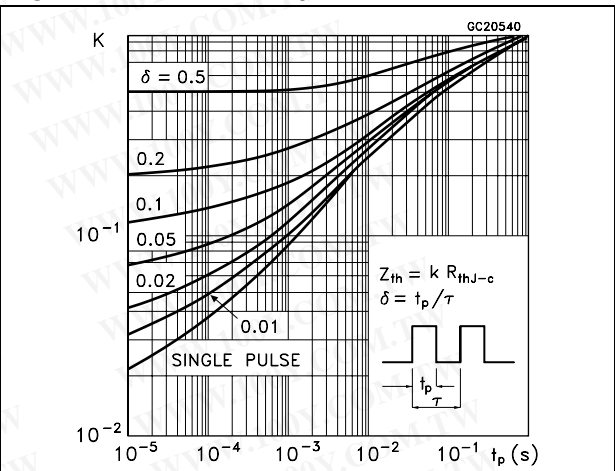


Figure 4. Output characteristics

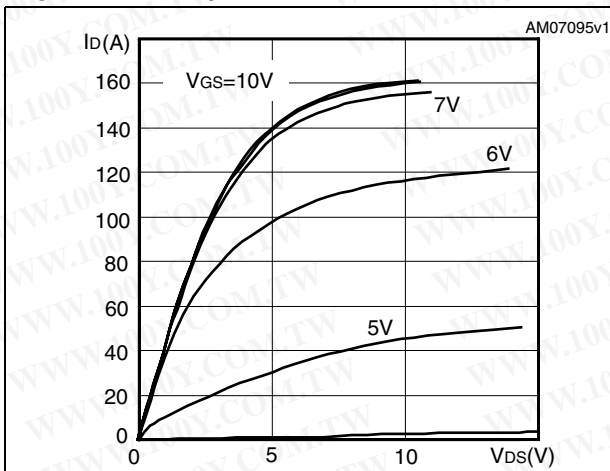


Figure 5. Transfer characteristics

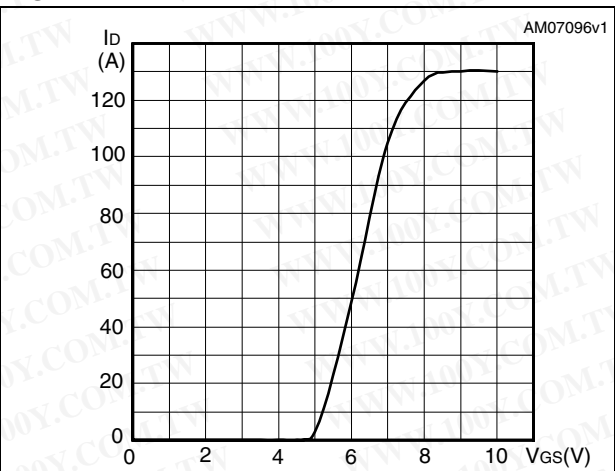


Figure 6. Gate charge vs gate-source voltage

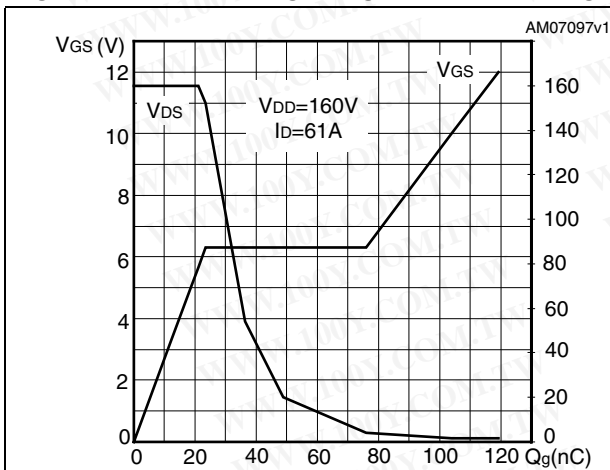


Figure 7. Static drain-source on resistance

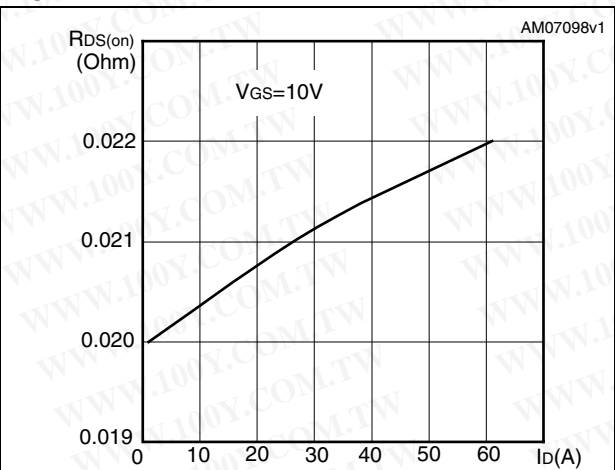


Figure 8. Capacitance variations

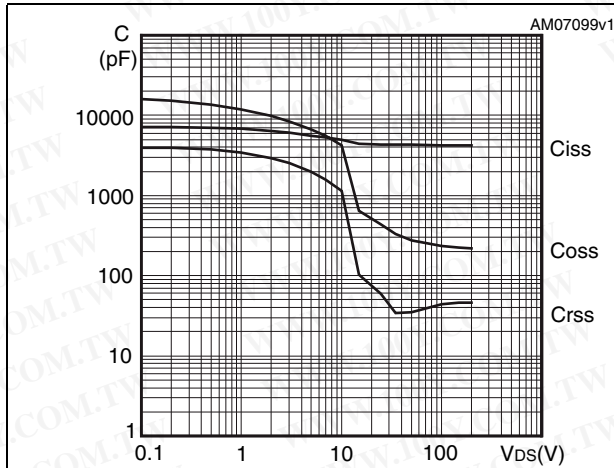


Figure 9. Output capacitance stored energy

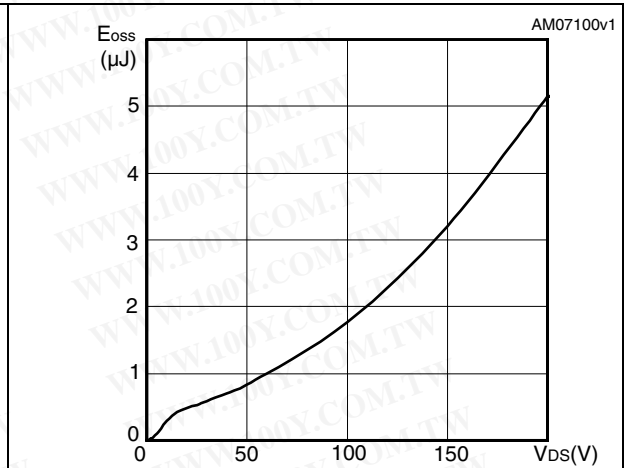


Figure 10. Normalized gate threshold voltage vs temperature

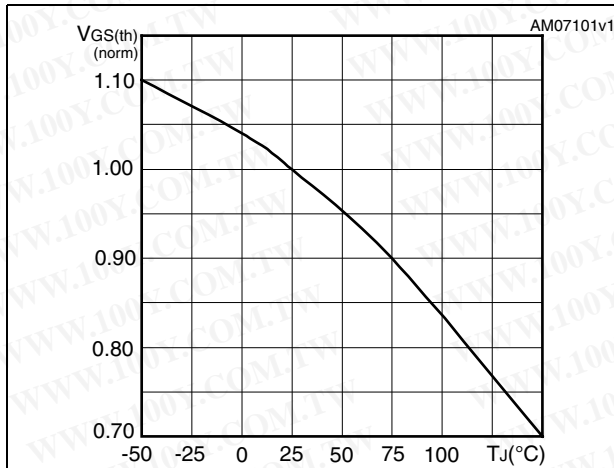


Figure 11. Normalized on resistance vs temperature

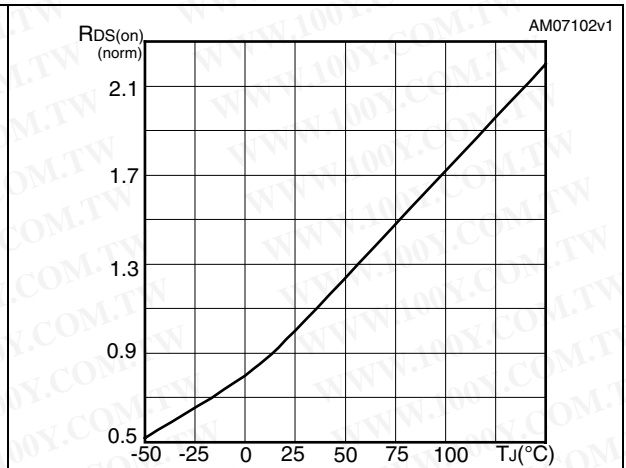


Figure 12. Source-drain diode forward characteristics

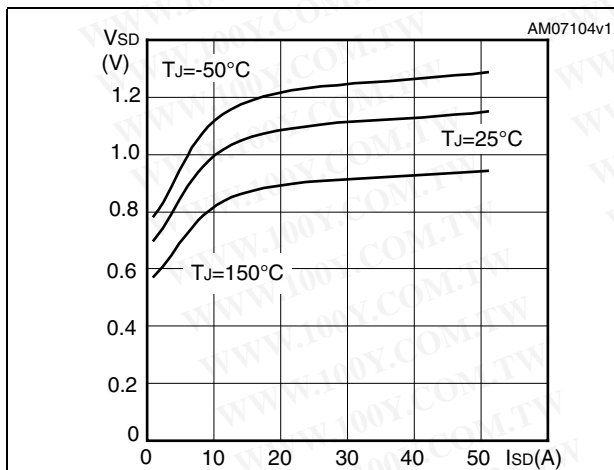
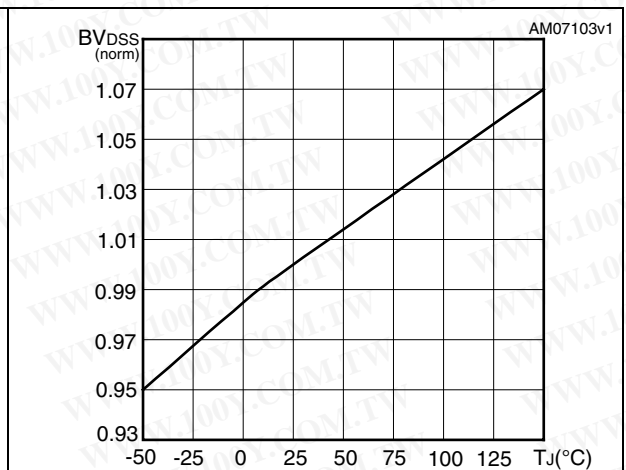


Figure 13. Normalized BV<sub>DSS</sub> vs temperature



### 3 Test circuits

Figure 14. Switching times test circuit for resistive load

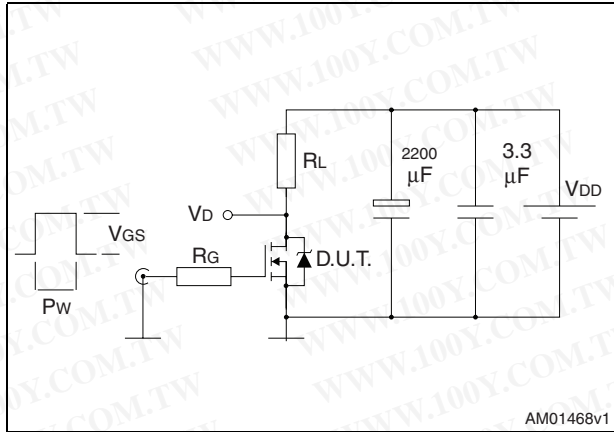


Figure 15. Gate charge test circuit

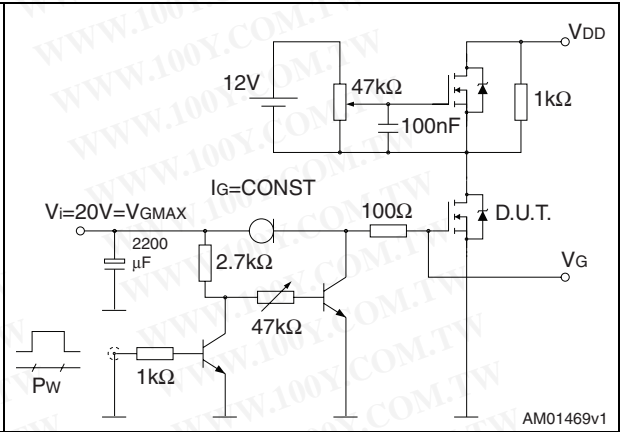


Figure 16. Test circuit for inductive load switching and diode recovery times

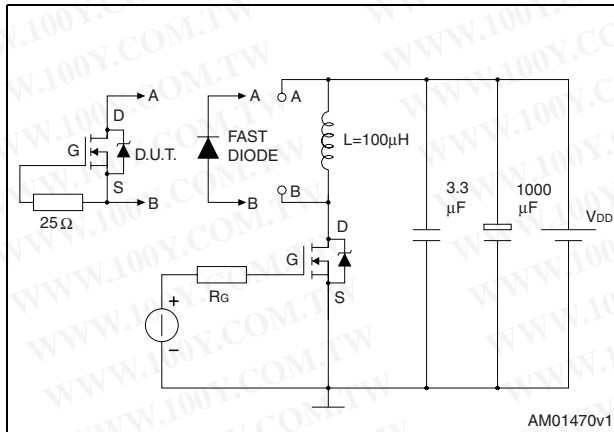


Figure 17. Unclamped inductive load test circuit

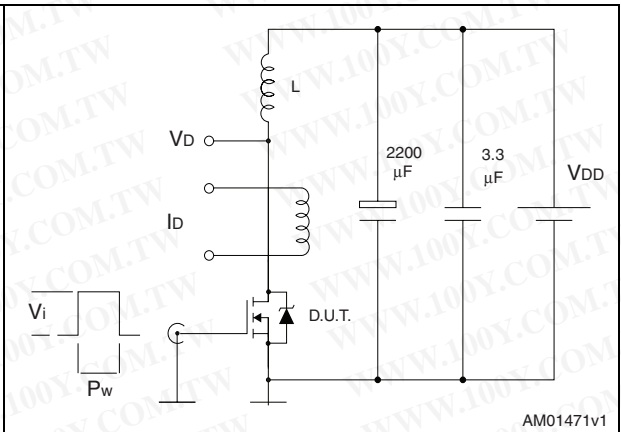


Figure 18. Unclamped inductive waveform

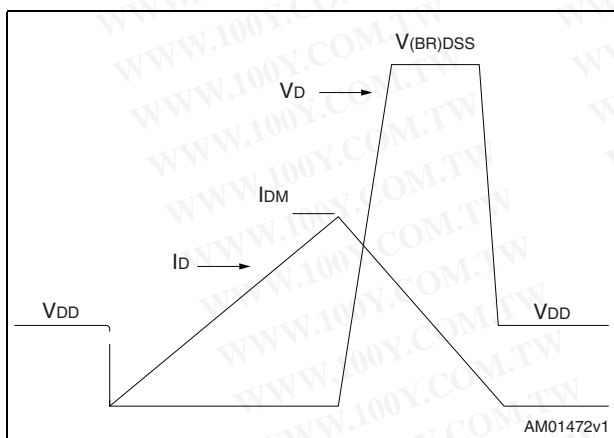
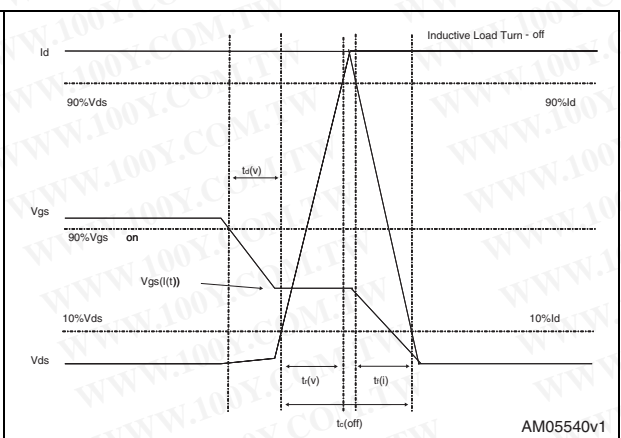


Figure 19. Switching time waveform



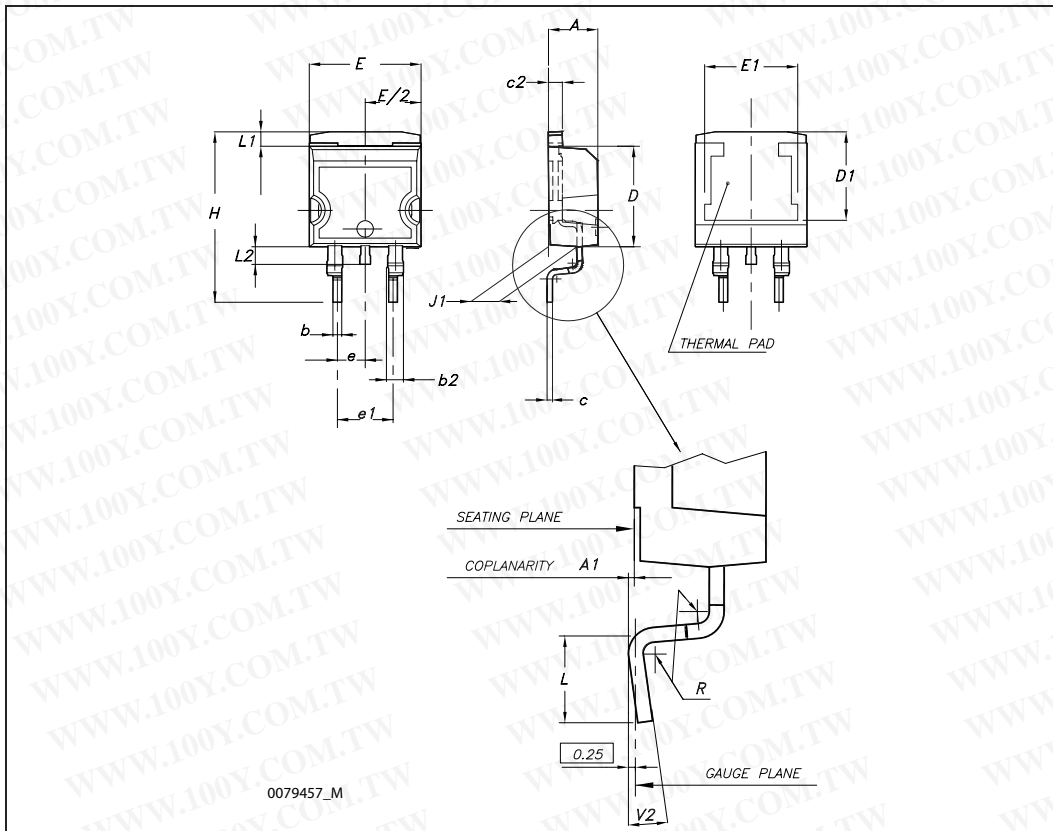


## 4 Package mechanical data

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.

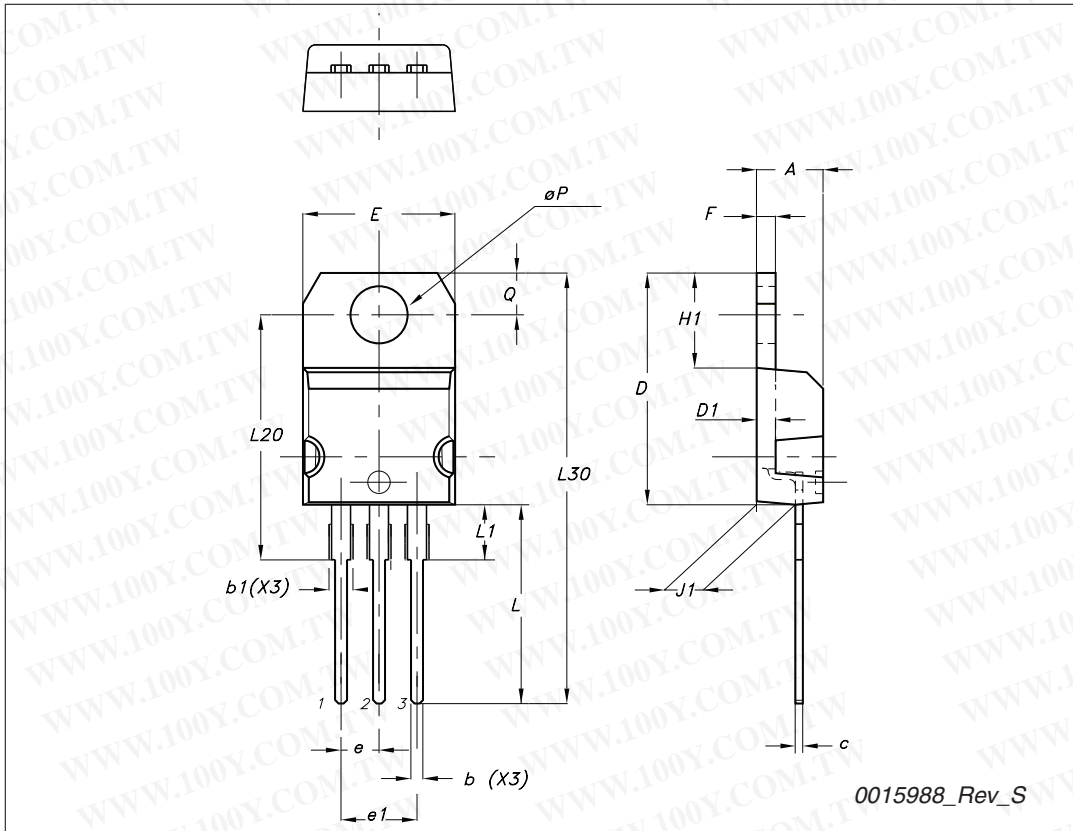
**D<sup>2</sup>PAK (TO-263) mechanical data**

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	0.03		0.23	0.001		0.009
b	0.70		0.93	0.027		0.037
b2	1.14		1.70	0.045		0.067
c	0.45		0.60	0.017		0.024
c2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1	7.50			0.295		
E	10		10.40	0.394		0.409
E1	8.50			0.334		
e		2.54			0.1	
e1	4.88		5.28	0.192		0.208
H	15		15.85	0.590		0.624
J1	2.49		2.69	0.099		0.106
L	2.29		2.79	0.090		0.110
L1	1.27		1.40	0.05		0.055
L2	1.30		1.75	0.051		0.069
R		0.4			0.016	
V2	0°		8°	0°		8°



TO-220 type A mechanical data

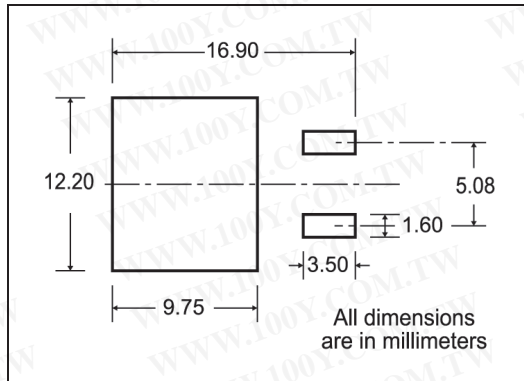
Dim	mm		
	Min	Typ	Max
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
∅P	3.75		3.85
Q	2.65		2.95



0015988\_Rev\_S

# 5 Packaging mechanical data

## D<sup>2</sup>PAK FOOTPRINT



## TAPE AND REEL SHIPMENT

**TAPE MECHANICAL DATA**

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956

**REEL MECHANICAL DATA**

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

## 6 Revision history

**Table 8. Document revision history**

Date	Revision	Changes
01-Jul-2009	1	First release
03-Jul-2010	2	Document status promoted from preliminary data to datasheet



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