



STB11NM80, STF11NM80 STP11NM80, STW11NM80

N-channel 800 V, 0.35 Ω , 11 A MDmesh™ Power MOSFET
 TO-220, TO-220FP, D²PAK, TO-247

Features

Type	V _{DSS}	R _{DS(on)} max	R _{DS(on)} *Q _g	I _D
STB11NM80	800 V	< 0.40 Ω	14 Ω *nC	11 A
STF11NM80				
STP11NM80				
STW11NM80				

- Low input capacitance and gate charge
- Low gate input resistance
- Best R_{DS(on)}*Q_g in the industry

Application

- Switching applications

Description

The MDmesh™ associates the multiple drain process with the company's PowerMesh™ horizontal layout assuring an outstanding low on-resistance. The adoption of the company's proprietary strip technique yields overall dynamic performance that is significantly better than that of similar competition's products.

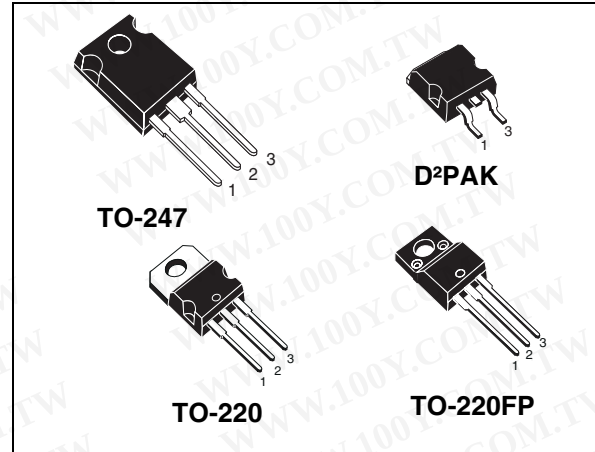


Figure 1. Internal schematic diagram

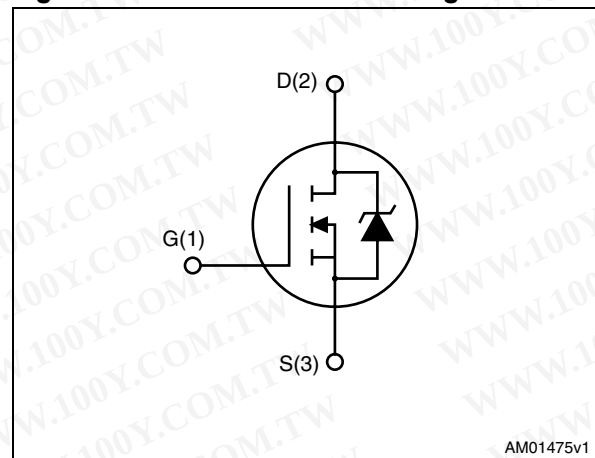


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB11NM80	B11NM80	D ² PAK	Tape and reel
STF11NM80	F11NM80	TO-220FP	Tube
STP11NM80	P11NM80	TO-220	
STW11NM80	W11NM80	TO-247	

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220, D ² PAK, TO-247	TO-220FP	
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	800		V
V_{GS}	Gate-source voltage	± 30		V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	11	11 ⁽¹⁾	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	8	8 ⁽¹⁾	A
$I_{DM}^{(2)}$	Drain current (pulsed)	44	44 ⁽¹⁾	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	150	35	W
	Derating factor	1.2	0.28	W/ $^{\circ}\text{C}$
V_{ISO}	Insulation withstand voltage (DC)		2500	V
T_J T_{stg}	Operating junction temperature Storage temperature	-65 to 150		$^{\circ}\text{C}$

1. Limited only by the maximum temperature allowed
2. Pulse width limited by safe operating area

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		TO-220, D ² PAK, TO-247	TO-220FP	
$R_{thj-case}$	Thermal resistance junction-case max	0.83	3.6	$^{\circ}\text{C}/\text{W}$
R_{thj-a}	Thermal resistance junction-ambient max	62.5		$^{\circ}\text{C}/\text{W}$
T_I	Maximum lead temperature for soldering purpose	300		$^{\circ}\text{C}$

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_J max)	2.5	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	400	mJ

2 Electrical characteristics

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

Table 5. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0$	800			V
$dv/dt^{(1)}$	Drain source voltage slope	$V_{DD} = 640\text{ V}$, $I_D = 11\text{ A}$, $V_{GS} = 10\text{ V}$		30		V/ns
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$, $V_{DS} = \text{Max rating @ } 125^{\circ}\text{C}$			10 100	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 30\text{ V}$			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	$V_{GS} = 10\text{ V}$, $I_D = 5.5\text{ A}$		0.35	0.40	Ω

1. Characteristic value at turn off on inductive load

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$, $I_D = 7.5\text{ A}$	-	8	-	S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	1630 750 30	-	pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 640\text{ V}$, $I_D = 11\text{ A}$ $V_{GS} = 10\text{ V}$ Figure 10	-	43.6 11.6 21	-	nC nC nC
R_g	Gate input resistance	$f = 1\text{ MHz}$ Gate DC Bias=0 Test signal level=20 mV open drain	-	2.7	-	Ω
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	$V_{DD} = 400\text{ V}$, $I_D = 5.5\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ Figure 17	-	22 17 46 15	-	ns ns ns ns

1. Pulsed: pulse duration=300 μs , duty cycle 1.5%

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		11	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		44	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=11\text{ A}$, $V_{GS}=0$	-		0.86	V
t_{rr}	Reverse recovery time	$I_{SD}=11\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD}= 50\text{ V}$	-	612		ns
Q_{rr}	Reverse recovery charge			7.22		μC
I_{RRM}	Reverse recovery current			23.6		A
t_{rr}	Reverse recovery time	$I_{SD}=11\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD}= 50\text{ V}$, $T_j=150\text{ }^\circ\text{C}$	-	970		ns
Q_{rr}	Reverse recovery charge			11.25		μC
I_{RRM}	Reverse recovery current			23.2		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220, D²PAK, TO-247

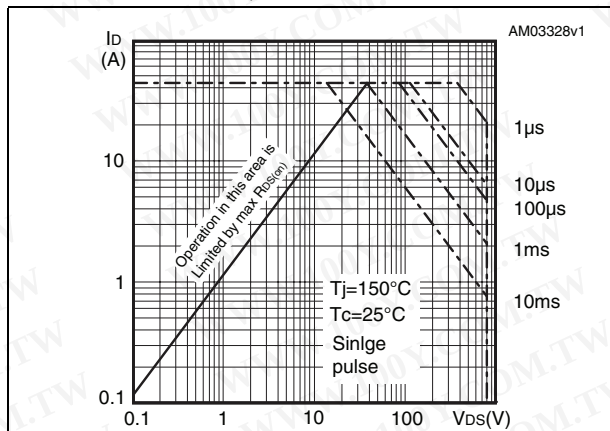


Figure 3. Thermal impedance for TO-220, D²PAK, TO-247

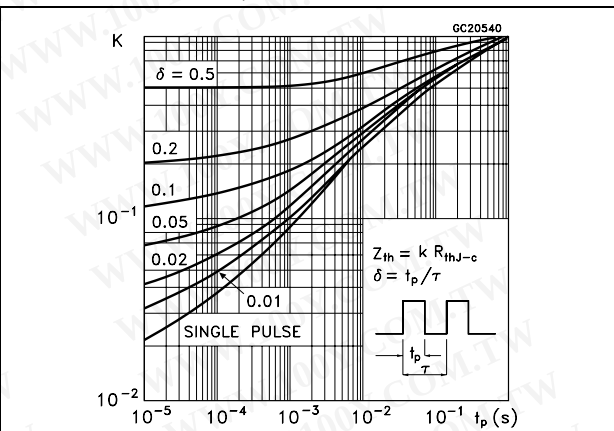


Figure 4. Safe operating area for TO-220FP

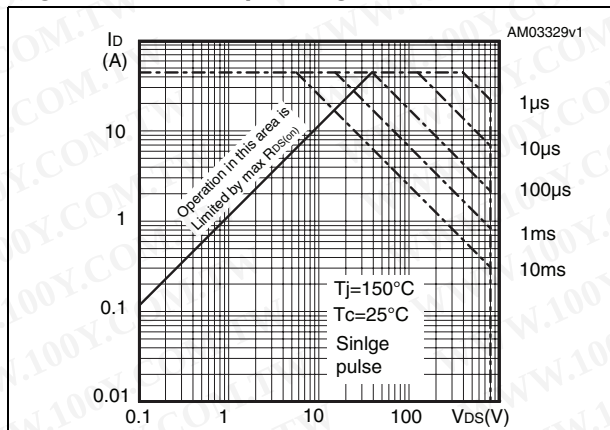


Figure 5. Thermal impedance for TO-220FP

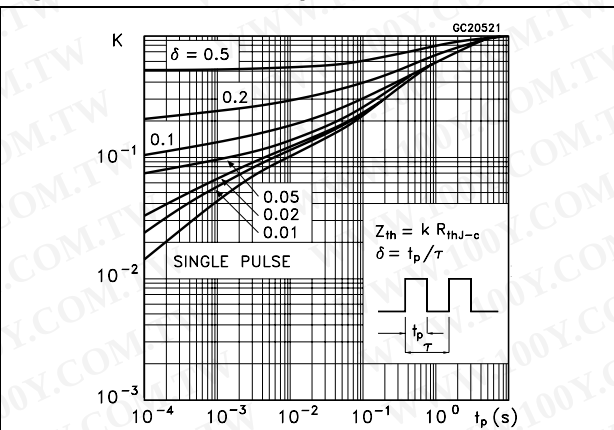


Figure 6. Output characteristics

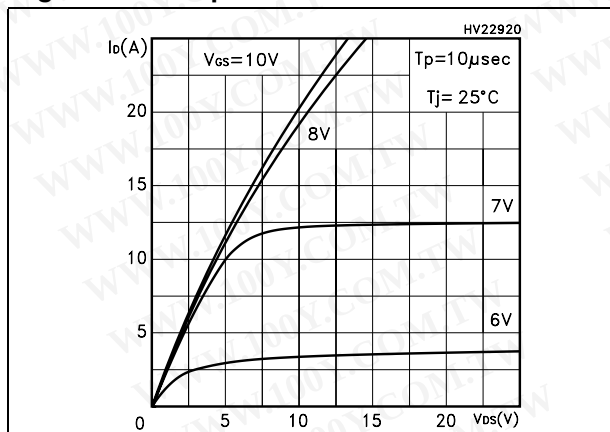


Figure 7. Output characteristics

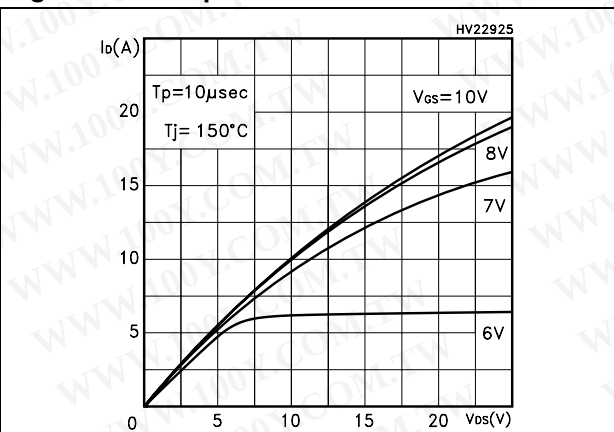


Figure 8. Transfer characteristics

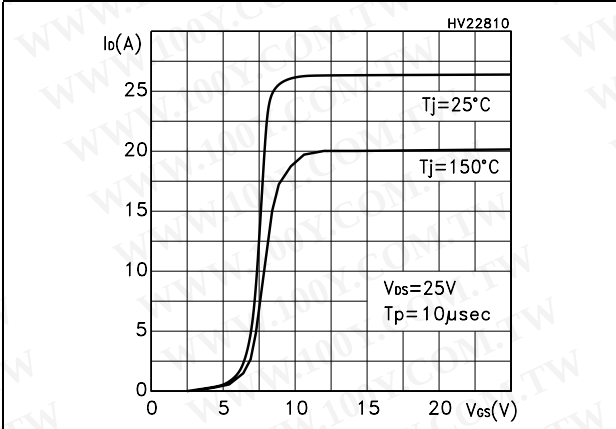


Figure 9. Transconductance

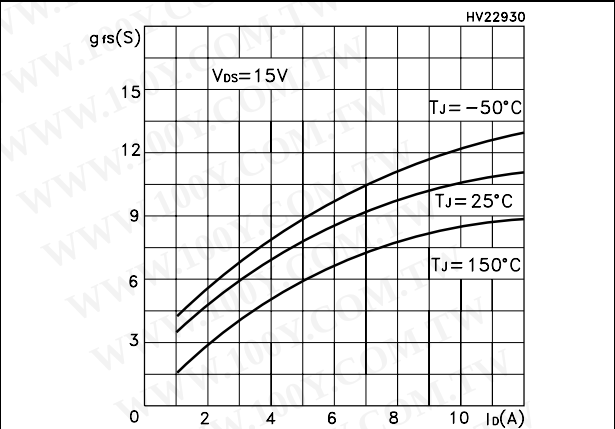


Figure 10. Gate charge vs gate-source voltage

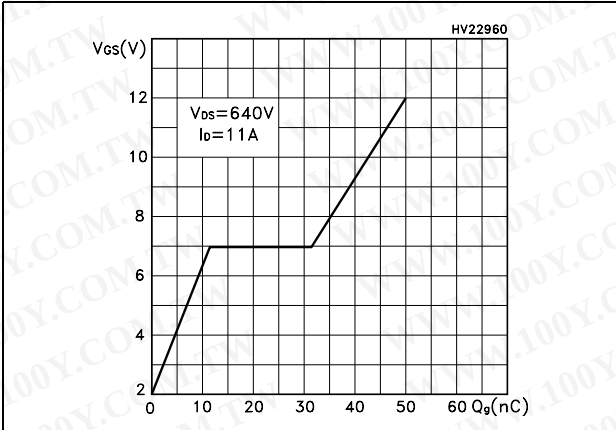


Figure 11. Capacitance variations

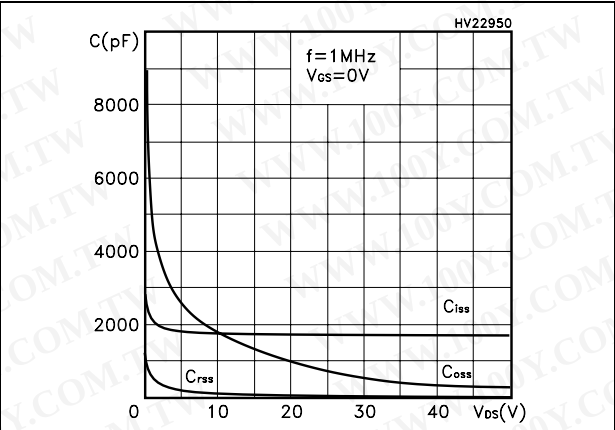


Figure 12. Normalized gate threshold voltage vs temperature

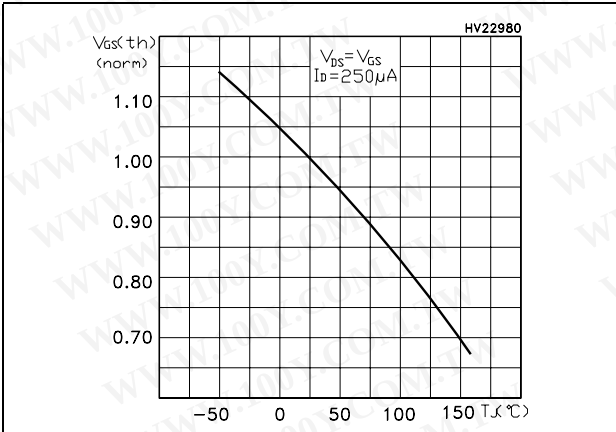


Figure 13. Static drain-source on resistance

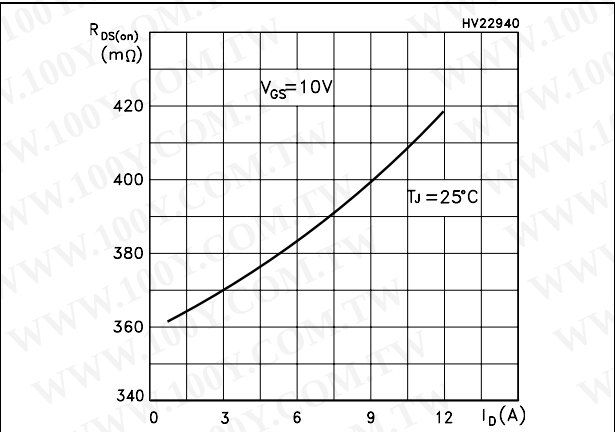


Figure 14. Source-drain diode forward characteristics

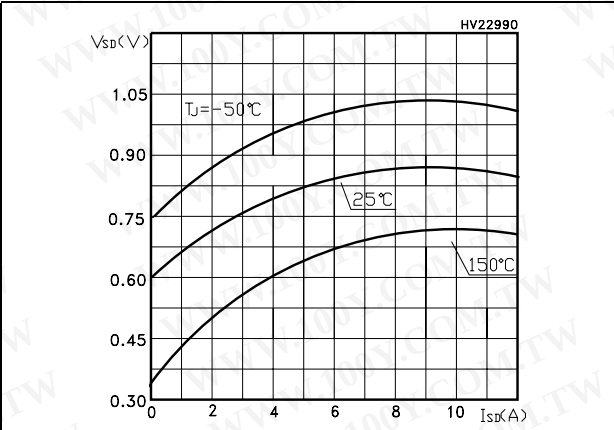


Figure 15. Normalized on resistance vs temperature

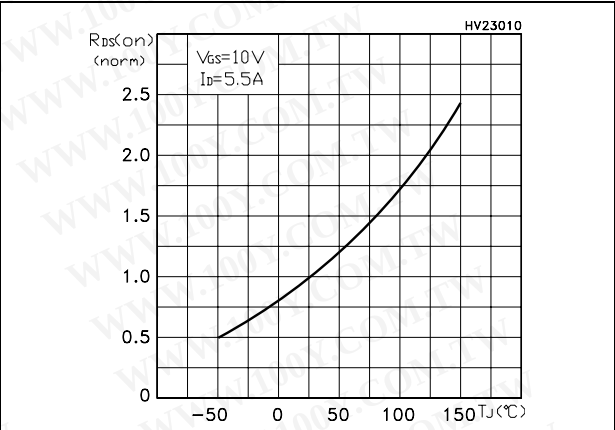
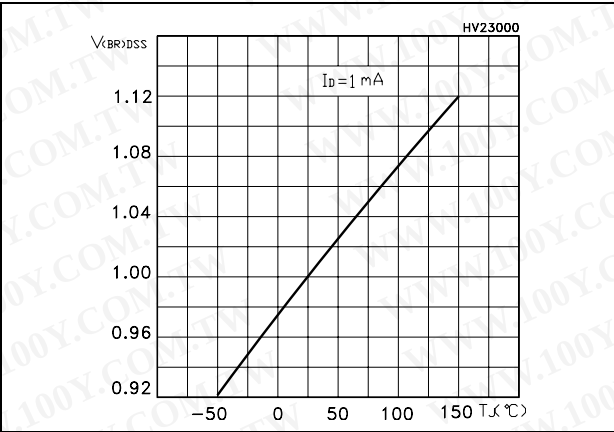


Figure 16. Normalized $B_{V_{DSS}}$ vs temperature



3 Test circuits

Figure 17. Switching times test circuit for resistive load

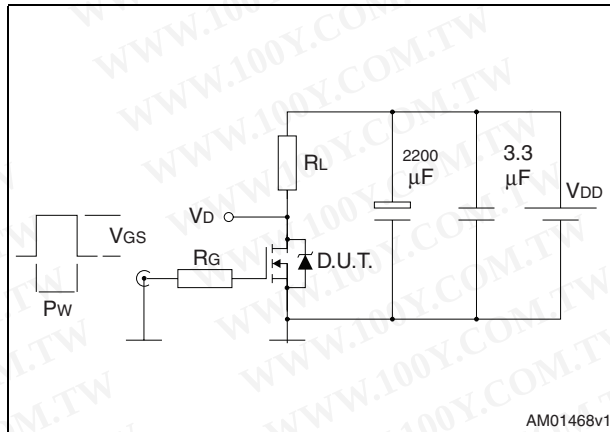


Figure 18. Gate charge test circuit

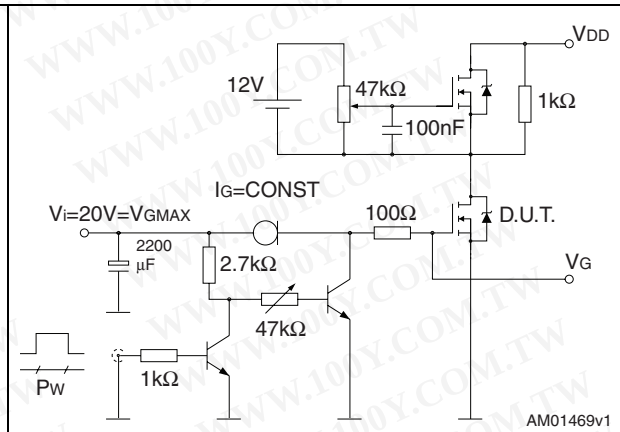


Figure 19. Test circuit for inductive load switching and diode recovery times

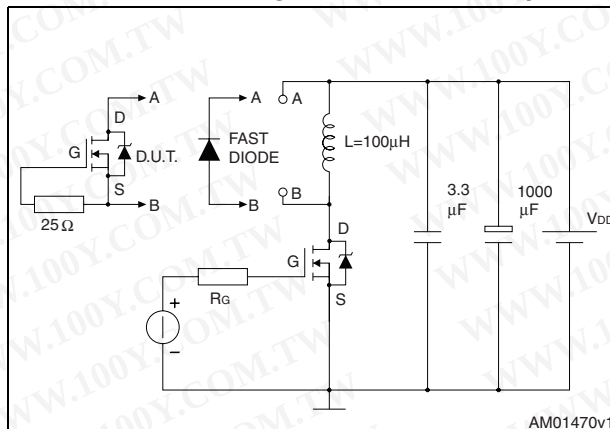


Figure 20. Unclamped inductive load test circuit

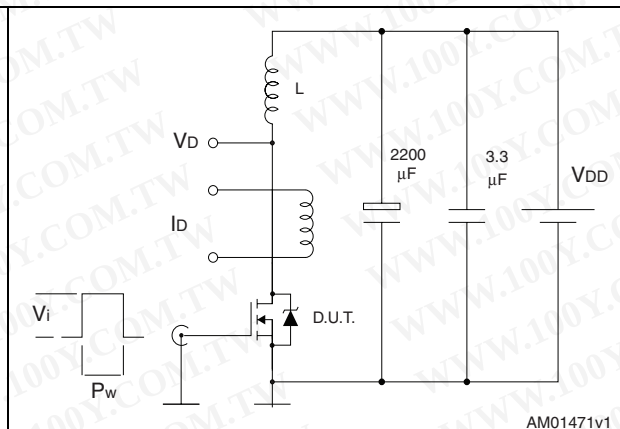


Figure 21. Unclamped inductive waveform

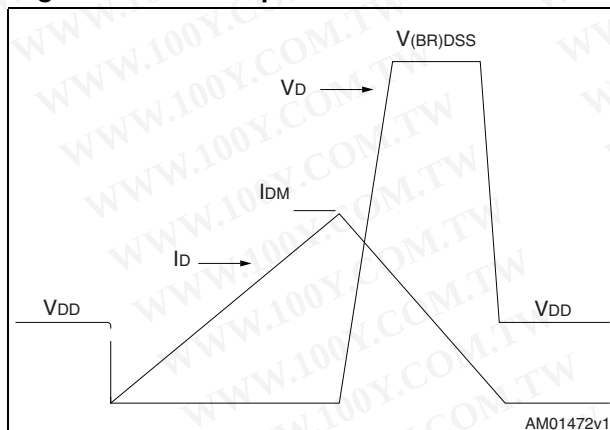
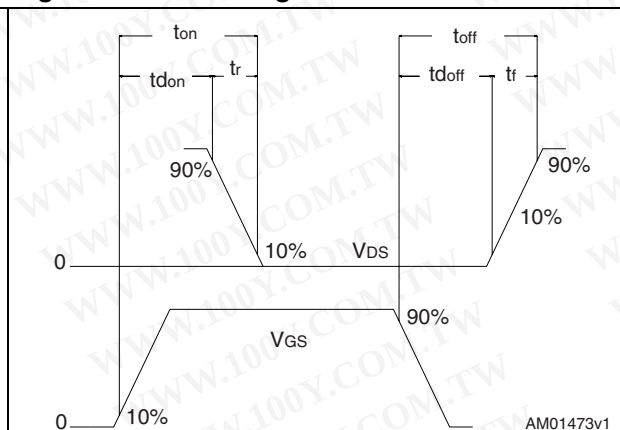


Figure 22. Switching time waveform



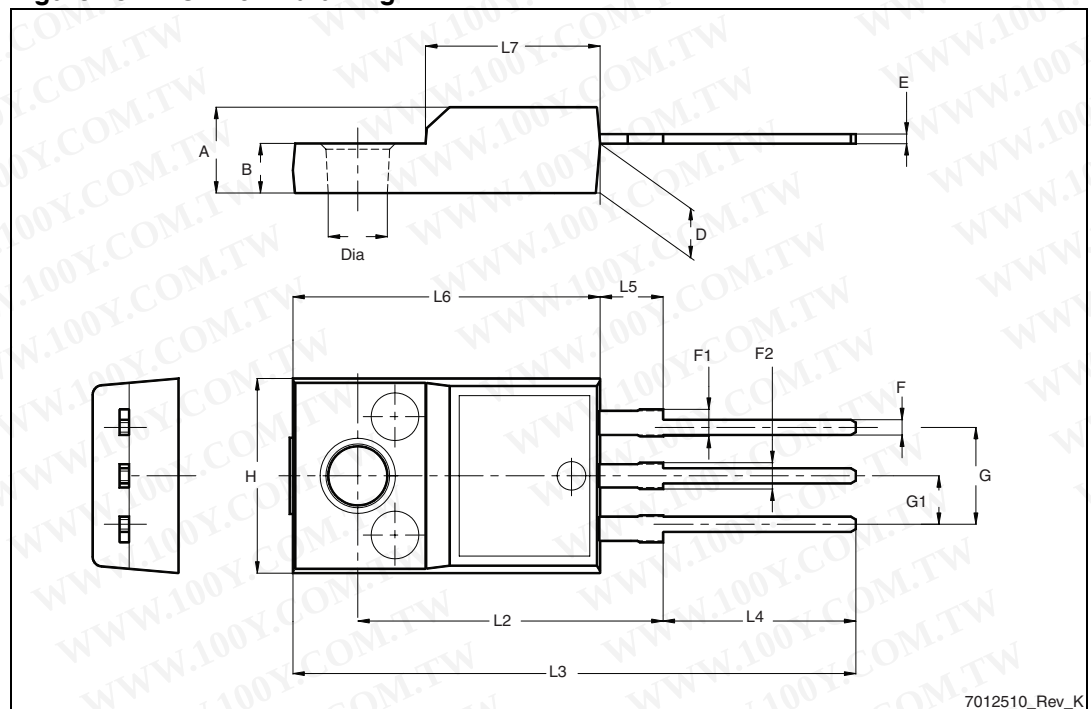
4 Package mechanical data

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. ECOPACK is an ST trademark.

Table 8. TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

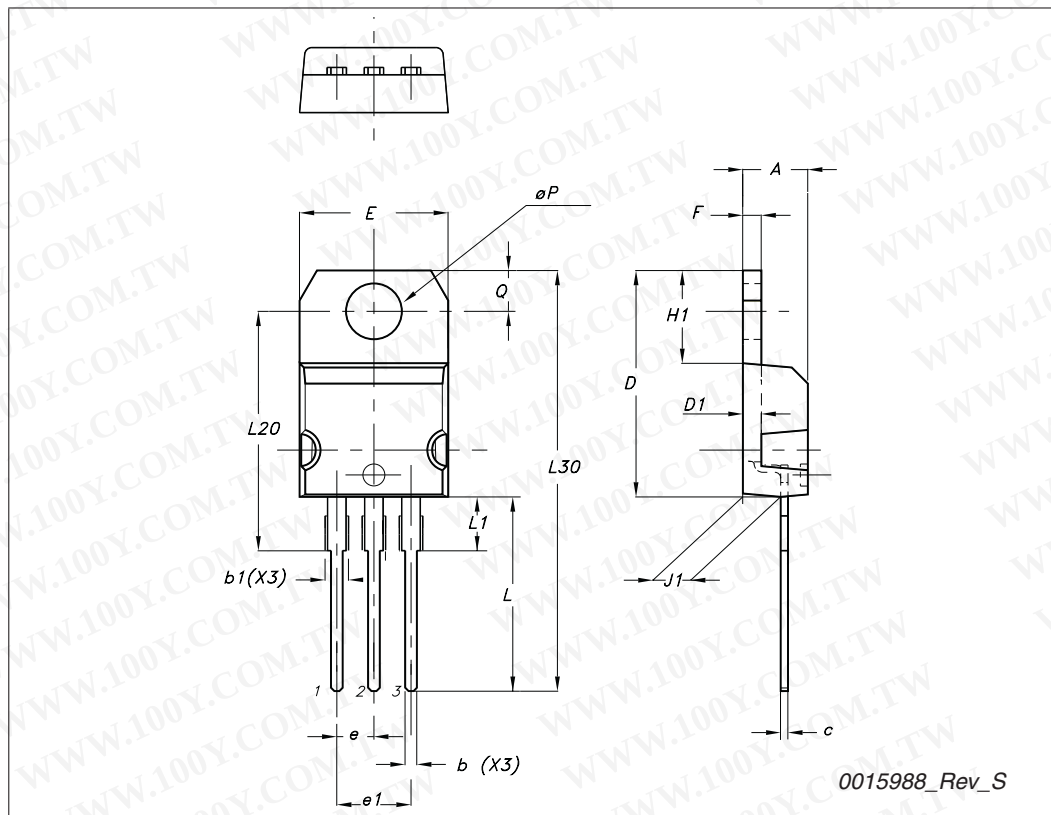
Figure 23. TO-220FP drawing



7012510_Rev_K

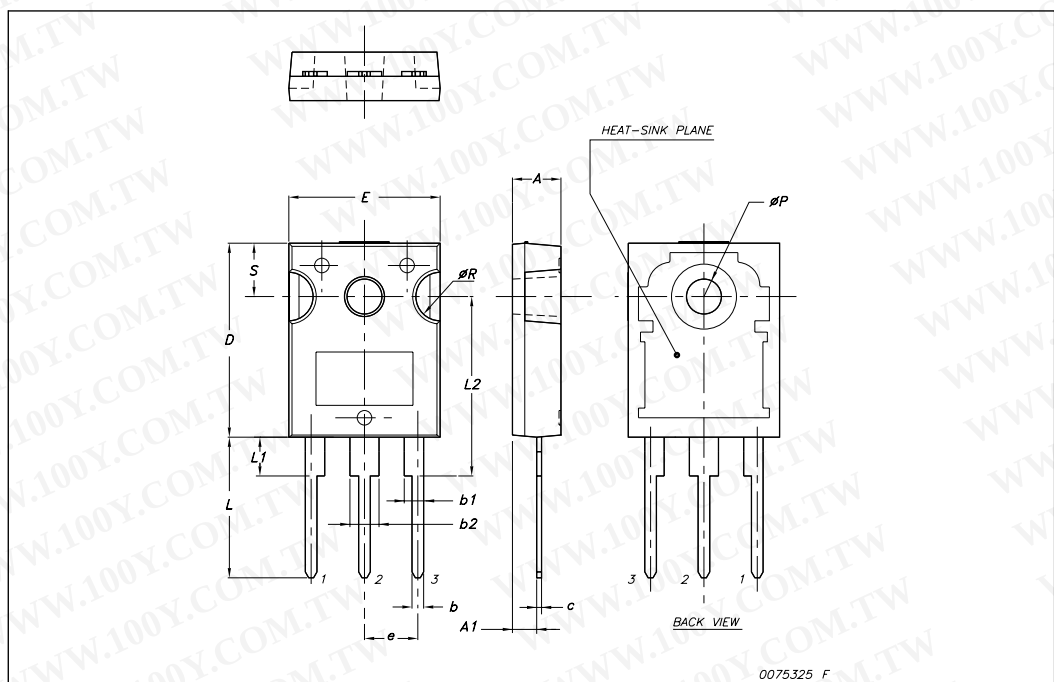
TO-220 type A mechanical data

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



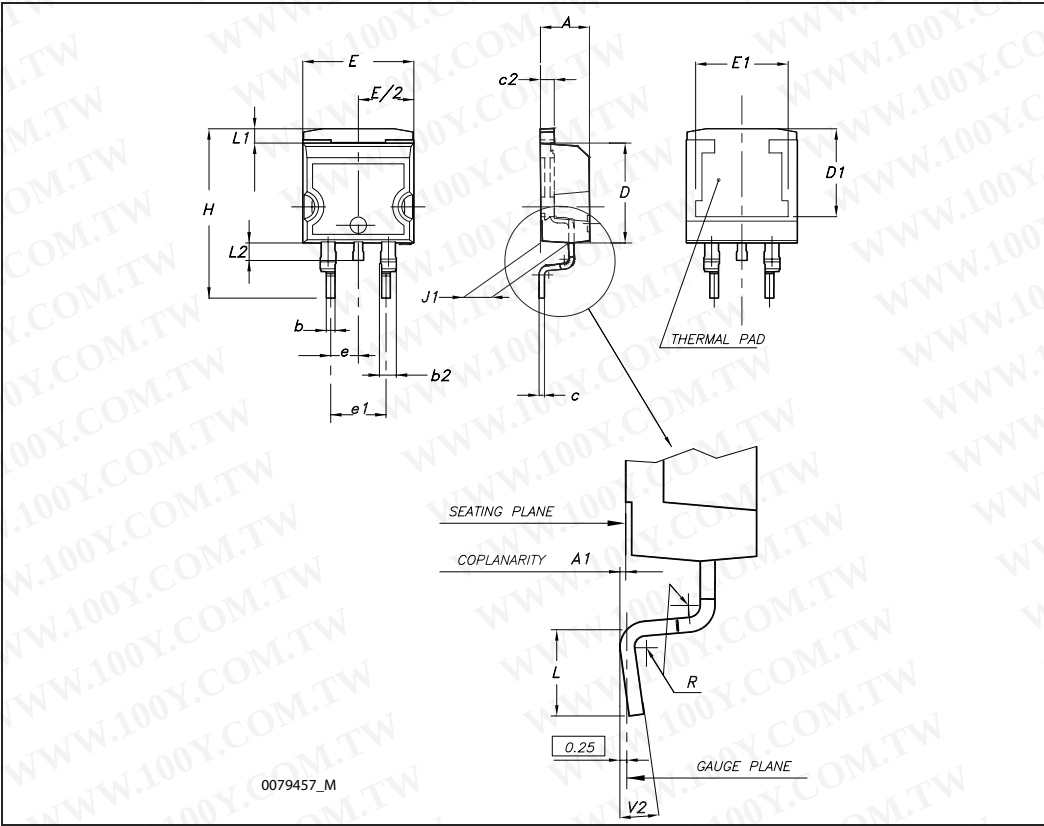
TO-247 Mechanical data

Dim.	mm.		
	Min.	Typ	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
øP	3.55		3.65
øR	4.50		5.50
S		5.50	



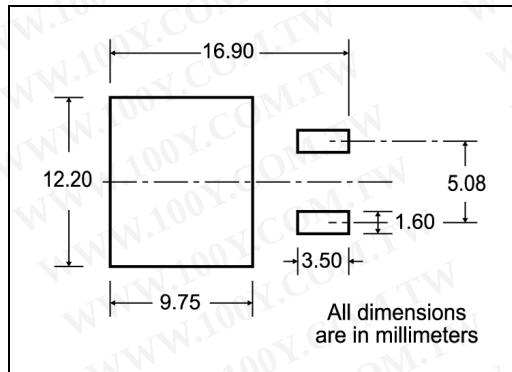
D²PAK (TO-263) mechanical data

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°

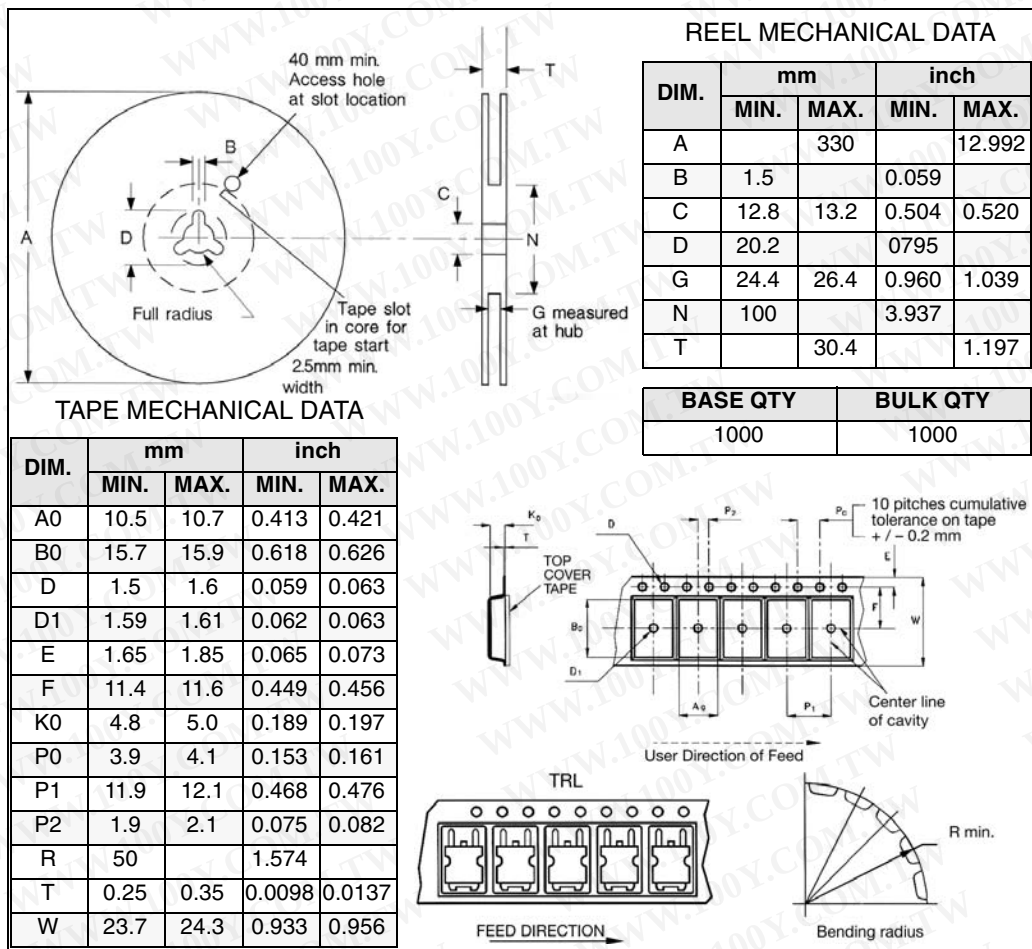


5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



6 Revision history

Table 9. Document revision history

Date	Revision	Changes
30-Sep-2004	4	Preliminary version
26-Nov-2005	5	Complete version
07-Apr-2006	6	Modified value on Figure 8
15-May-2006	7	New dv/dt value on Table 5
20-Jul-2006	8	The document has been reformatted
20-Dec-2007	9	Updated I _D value on Table 2: Absolute maximum ratings
24-Mar-2010	10	Inserted dv/dt value in Table 2: Absolute maximum ratings

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