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STB45NF06 STP45NF06

N-channel 60 V, 0.023 Ω , 38 A TO-220, D²PAK
STripFET™ II Power MOSFET

Features

Type	V _{DSS}	R _{DS(on)}	I _D
STP45NF06	60 V	<0.028 Ω	38 A
STB45NF06	60 V	<0.028 Ω	38 A

- Exceptional dv/dt capability
- Standard threshold drive
- 100% avalanche tested

Applications

- Switching application

Description

These devices are an N-channel Power MOSFET realized with the latest development of STMicroelectronics unique "single feature size" strip-based process. The resulting transistors show extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

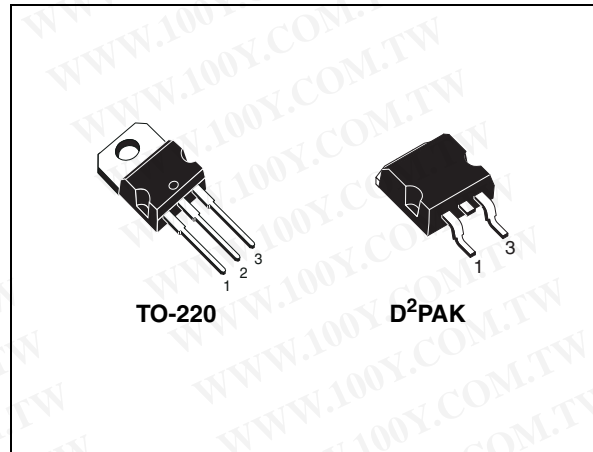


Figure 1. Internal schematic diagram

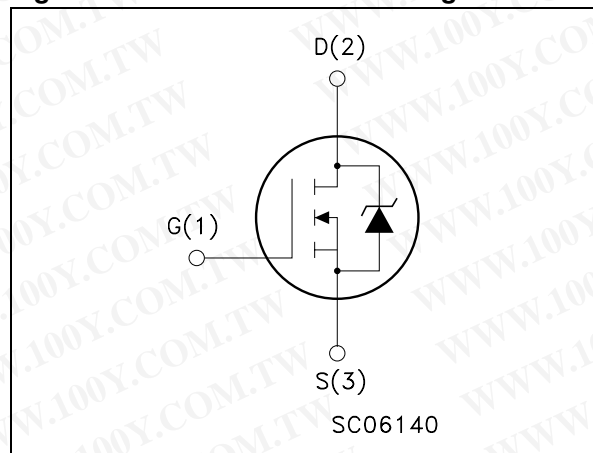


Table 1. Device summary

Order code	Marking	Package	Packaging
STP45NF06	P45NF06	TO-220	Tube
STB45NF06	B45NF06	D ² PAK	Tape and reel

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	60	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current (continuous) at $T_C = 25^\circ\text{C}$	38	A
I_D	Drain current (continuous) at $T_C = 100^\circ\text{C}$	26	A
$I_{DM}^{(1)}$	Drain current (pulsed)	152	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	80	W
	Derating factor	0.53	W/ $^\circ\text{C}$
$dv/dt^{(2)}$	Peak diode recovery voltage slope	8	V/ns
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 175	$^\circ\text{C}$

1. Pulse width limited by safe operating area.
2. $I_{SD} \leq 38\text{A}$, $di/dt \leq 300\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq T_{JMAX}$.

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		D ² PAK	TO-220	
$R_{thj-case}$	Thermal resistance junction-case max	1.87		$^\circ\text{C}/\text{W}$
R_{thj-a}	Thermal resistance junction-ambient max	62.5		
$R_{thj-pcb}^{(1)}$	Thermal resistance junction - pcb max	35		
T_l	Maximum lead temperature for soldering purpose	300		$^\circ\text{C}$

1. When mounted on 1 inch² FR-4 2 oz Cu board.

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_J max)	19	A
E_{AS}	Single pulse avalanche energy (starting $T_J=25^\circ\text{C}$, $I_d=I_{AR}$, $V_{DD}=40\text{V}$)	260	mJ

2 Electrical characteristics

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

Table 5. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\mu A, V_{GS} = 0$	60			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating},$ $V_{DS} = \text{Max rating} @ 125^{\circ}C$			1 10	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20V$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 19A$		0.023	0.028	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max},$ $I_D = 19 A$	-	18		S
C_{iss}	Input capacitance	$V_{DS} = 25V, f = 1 \text{ MHz},$ $V_{GS} = 0$	-	920		pF
C_{oss}	Output capacitance			225		pF
C_{rss}	Reverse transfer capacitance			80		pF
Q_g	Total gate charge	$V_{DD} = 48 V, I_D = 34 A$ $V_{GS} = 10V$	-	32	58	nC
Q_{gs}	Gate-source charge			6.5		nC
Q_{gd}	Gate-drain charge			14.5		nC

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

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time rise time	$V_{DD} = 30 V, I_D = 17 A,$ $R_G = 4.7 \Omega, V_{GS} = 10 V$ (see Figure 13)		12		ns
t_r				50		ns
$t_{d(off)}$	Turn-off delay time fall time	$V_{DD} = 30V, I_D = 17 A,$ $R_G = 4.7 \Omega, V_{GS} = 10 V$ (see Figure 13)		30		ns
t_f				10		ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current				38	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				152	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 38 \text{ A}$, $V_{GS}=0$			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 34 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 10 \text{ V}$, $T_j = 150^\circ\text{C}$ (see Figure 15)		65 150 5		ns nC A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

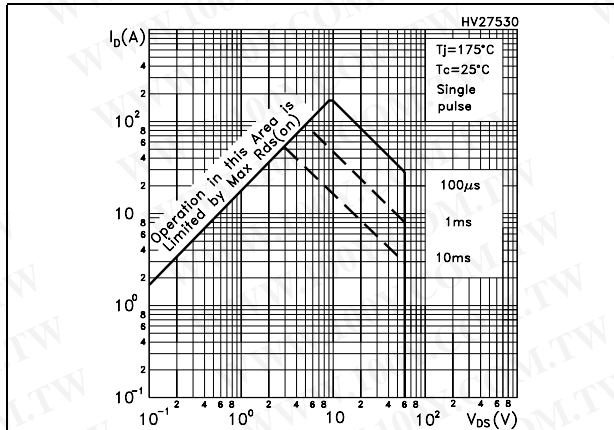


Figure 3. Thermal impedance

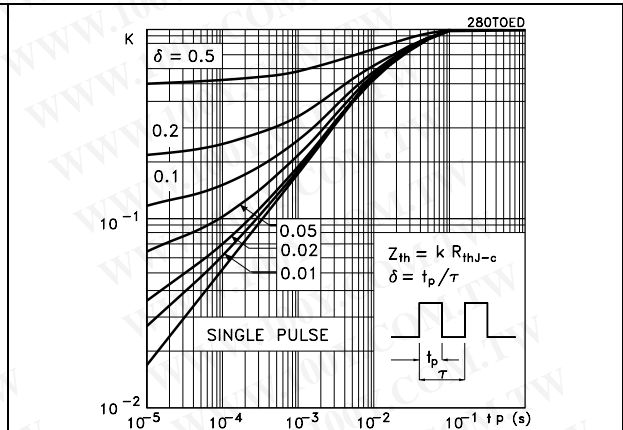


Figure 4. Output characteristics

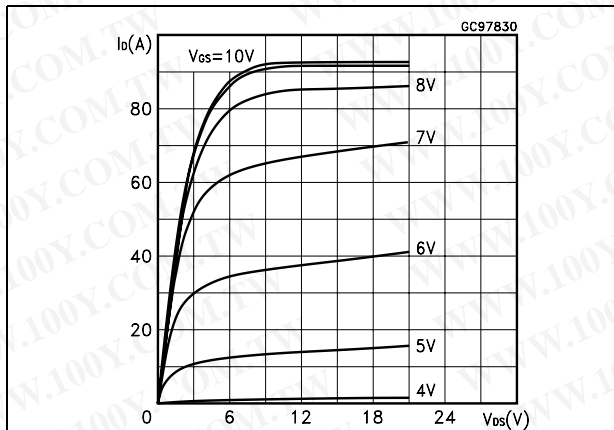


Figure 5. Transfer characteristics

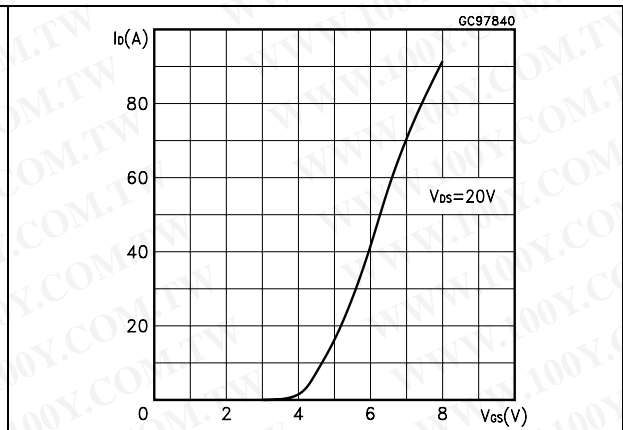


Figure 6. Normalized breakdown voltage vs. temperature

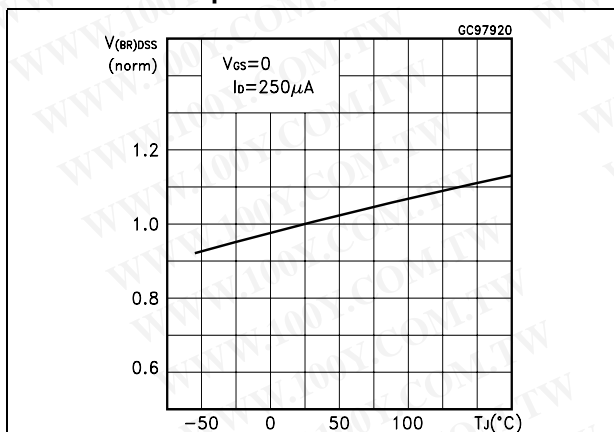


Figure 7. Static drain-source on resistance

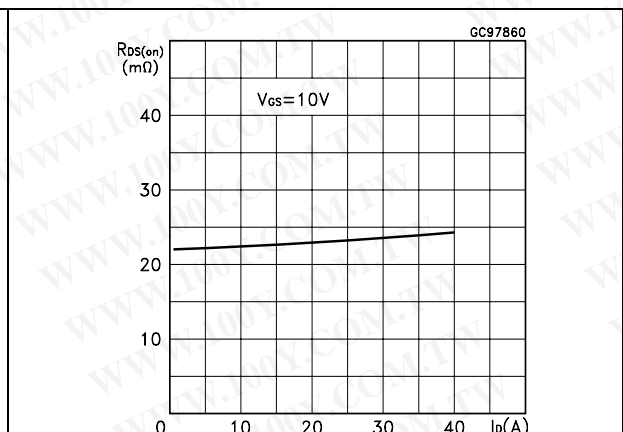


Figure 8. Gate charge vs. gate-source voltage

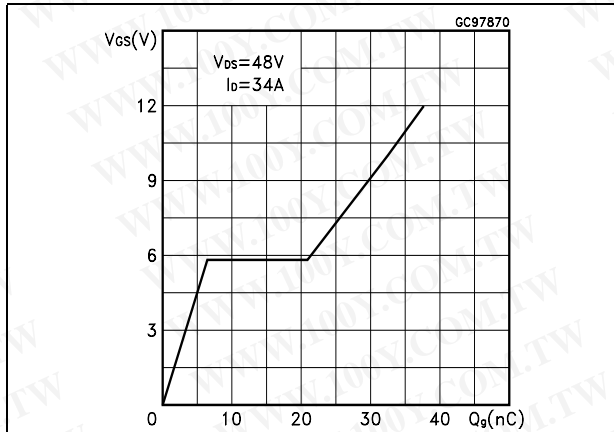


Figure 9. Capacitance variations

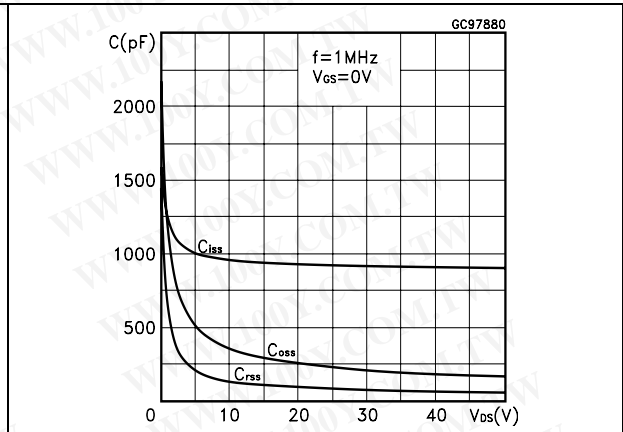


Figure 10. Normalized gate threshold voltage vs. temperature

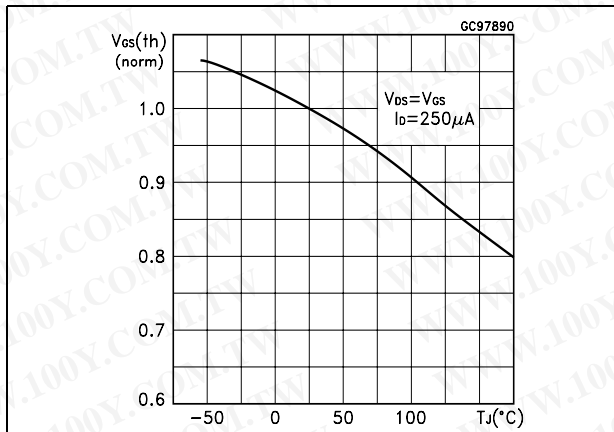


Figure 11. Normalized on resistance vs. temperature

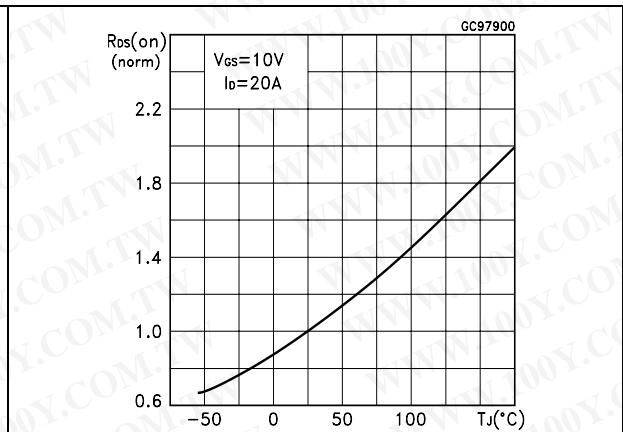
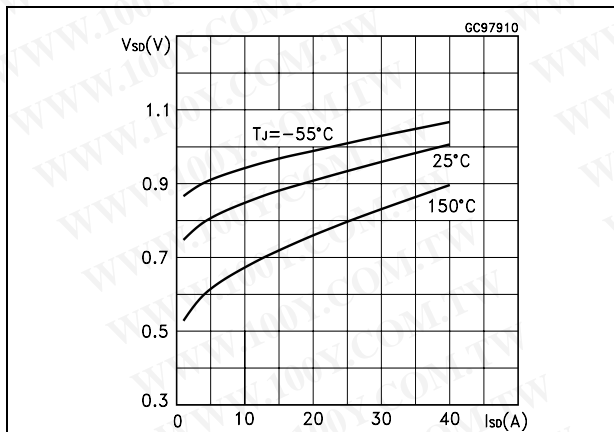


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

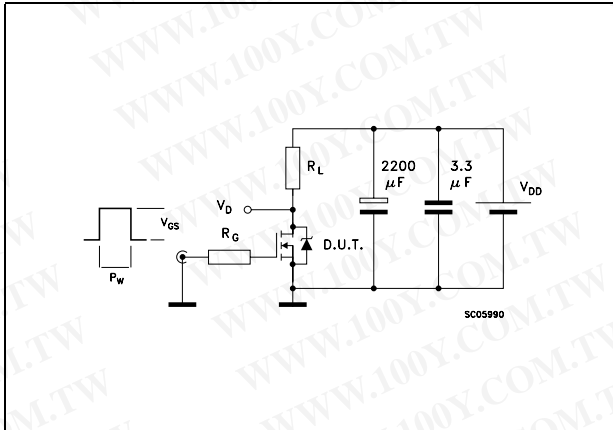


Figure 14. Gate charge test circuit

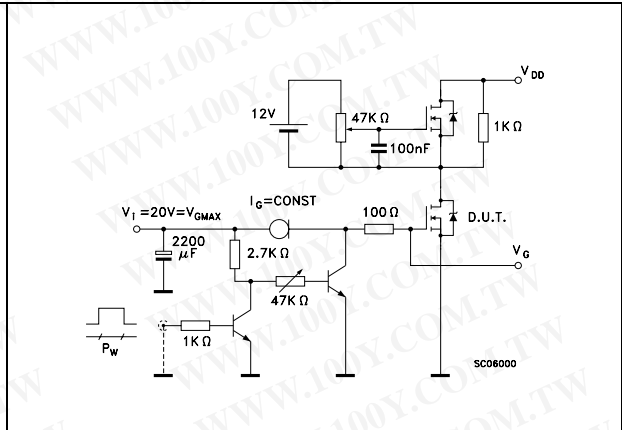


Figure 15. Test circuit for inductive load switching and diode recovery times

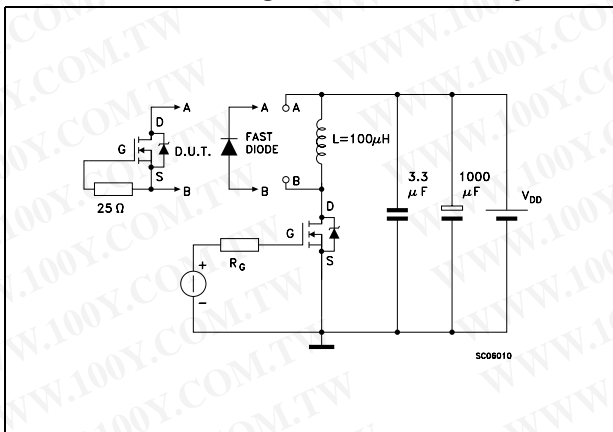


Figure 16. Unclamped Inductive load test circuit

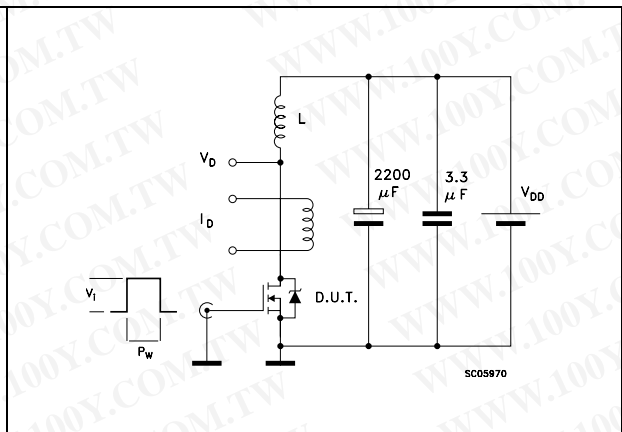


Figure 17. Unclamped inductive waveform

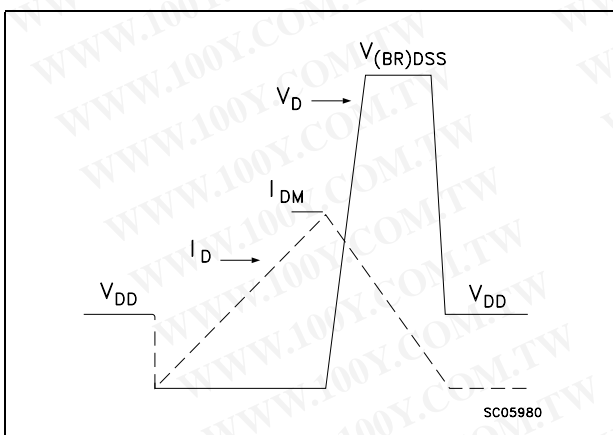
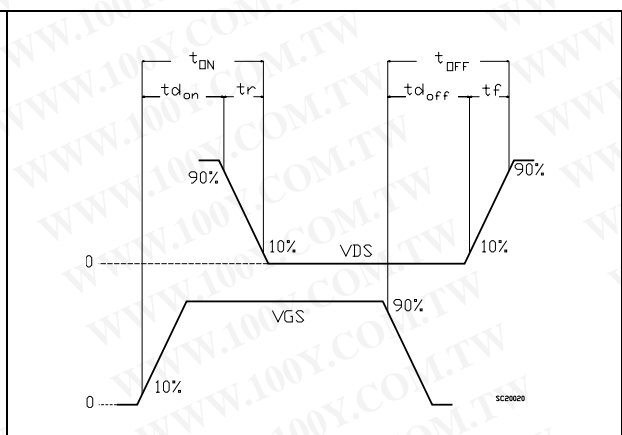


Figure 18. Switching time waveform

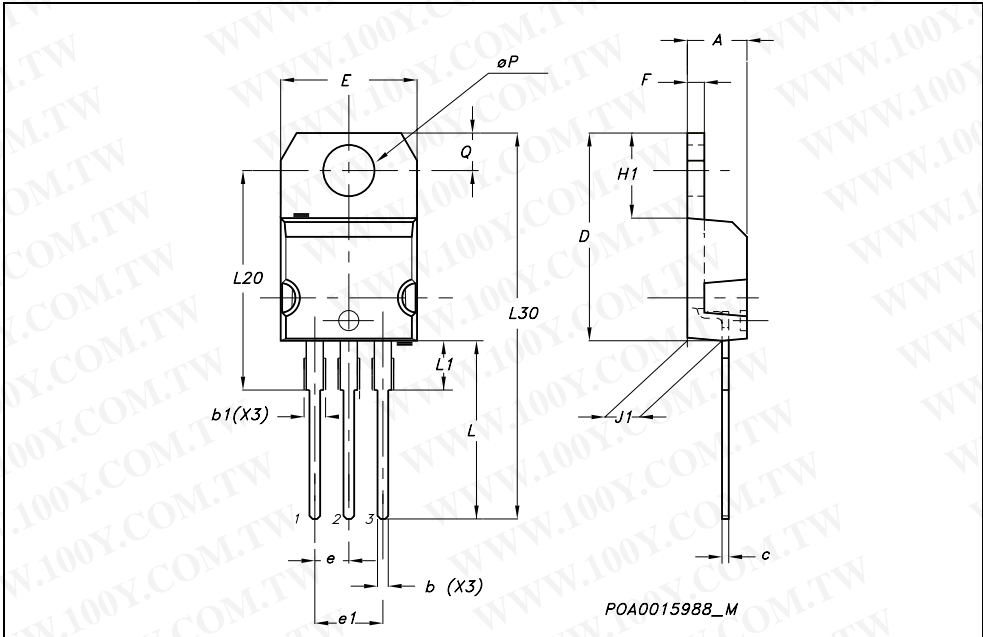


4 Package mechanical data

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.

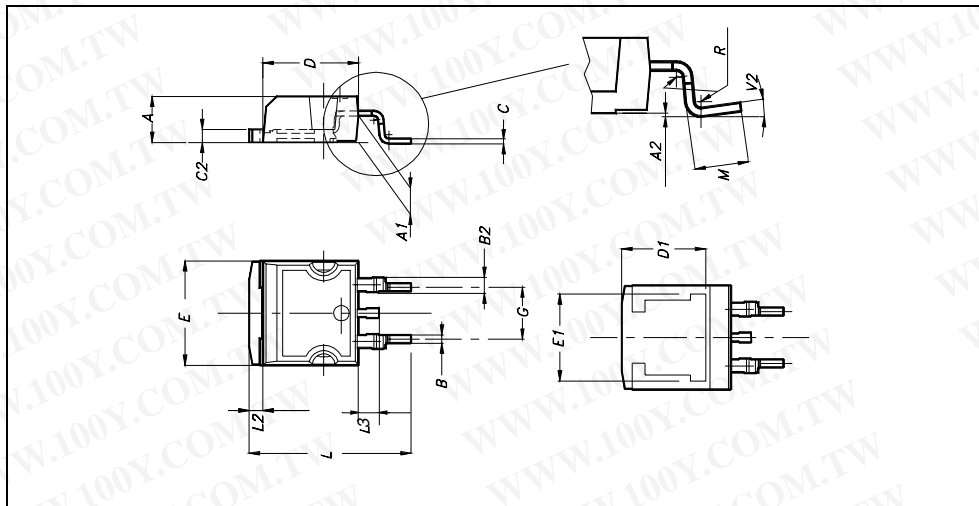
TO-220 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
øP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



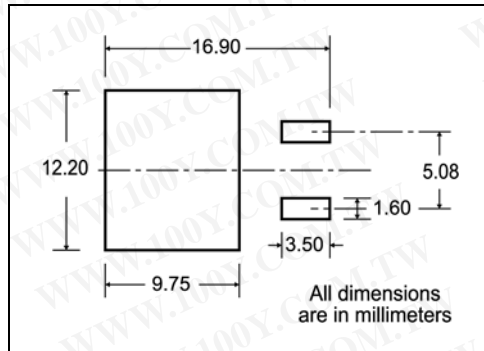
D²PAK MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		4°			



5 Packaging mechanical data

D²PAK 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

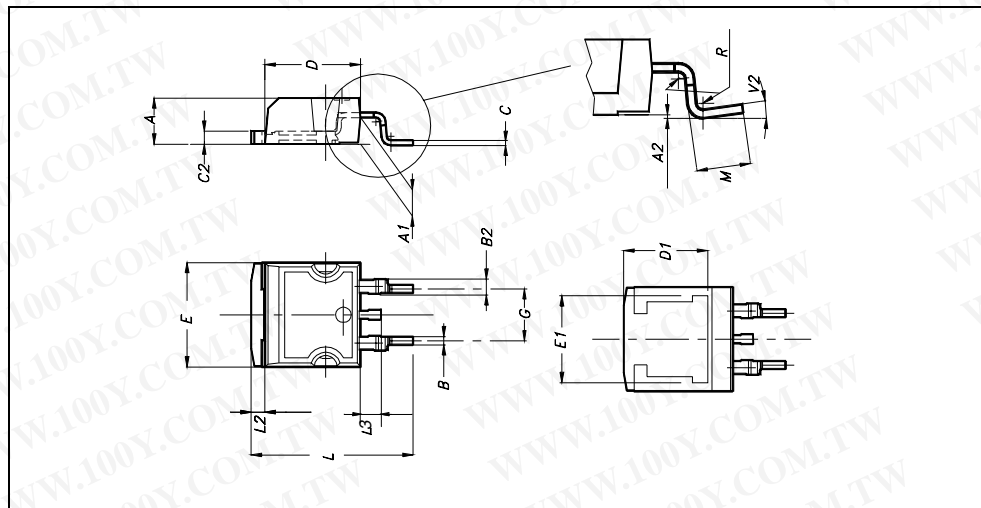
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

* on sales type

D²PAK MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		4°			



6 Revision history

Table 9. Revision history

Date	Revision	Changes
09-Sep-2004	1	Preliminary version.
04-Feb-2005	2	Complete version.
17-Aug-2006	3	New template. No content change.
13-Nov-2006	4	Inserted new value.
05-Jul-2010	5	Updated Section 2.1: Electrical characteristics (curves) .

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