



# STB75N20 STP75N20 - STW75N20

N-channel 200V - 0.028Ω - 75A - D<sup>2</sup>PAK - TO-220 - TO-247  
Low gate charge STripFET™ Power MOSFET

## General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STB75N20	200V	<0.034Ω	75A
STP75N20	200V	<0.034Ω	75A
STW75N20	200V	<0.034Ω	75A

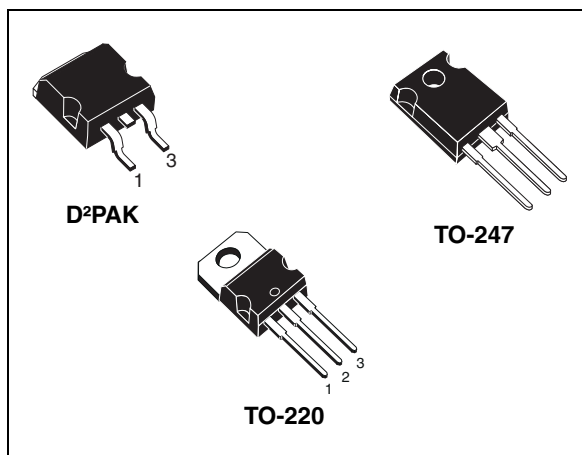
- Exceptional dv/dt capability
- Low gate charge
- 100% Avalanche tested

## Description

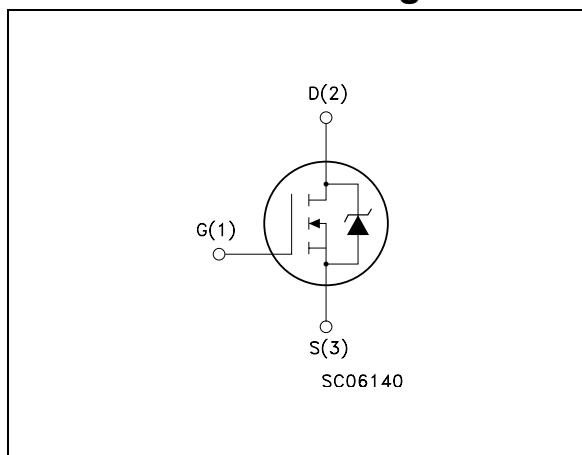
This Power MOSFET series realized with STMicroelectronics unique STripFET™ process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters

## Applications

- Switching application



## Internal schematic diagram



## Order codes

Part number	Marking	Package	Packaging
STB75N20T4	B75N20	D <sup>2</sup> PAK	Tape & reel
STP75N20	P75N20	TO-220	Tube
STW75N20	W75N20	TO-247	Tube

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	200	V
$V_{DGR}$	Drain-gate voltage ( $R_{GS} = 20\text{ k}\Omega$ )	200	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	75	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	47	A
$I_{DM}^{(1)}$	Drain current (pulsed)	300	A
	Derating factor	1.52	
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	190	W
$T_J$ $T_{stg}$	Operating junction temperature Storage temperature	-50 to 150	$^\circ\text{C}$

1.  $I_{SD} \leq 20\text{A}$ ,  $di/dt \leq 100\text{A}/\mu\text{s}$ ,  $V_{DD} = 80\% V_{(BR)DSS}$

**Table 2. Thermal resistance**

Symbol	Parameter	Value		Unit
		TO-220/D <sup>2</sup> PAK	TO-247	
$R_{thJC}$	Thermal resistance junction-case Max	0.66		$^\circ\text{C}/\text{W}$
$R_{thJ-pcb}^{(1)}$	Thermal resistance junction-pcb Max	34	--	$^\circ\text{C}/\text{W}$
$R_{thJA}$	Thermal resistance junction-ambient Max	62.5	40	$^\circ\text{C}/\text{W}$
$T_l$	Maximum lead temperature for soldering purpose	300		$^\circ\text{C}$

1. When mounted on inch<sup>2</sup>FR-4 board ( $t \leq 10\mu\text{s}$ )

**Table 3. Avalanche characteristics**

Symbol	Parameter	Max value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_J$ max)	37	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25^\circ\text{C}$ , $I_d = I_{AR}$ , $V_{dd} = 50\text{V}$ )	205	mJ

## 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	$I_D = 1mA, V_{GS} = 0$	200			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating},$ $V_{DS} = \text{Max rating} @ 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{DS} = \pm 20V$			$\pm 100$	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	$V_{GS} = 10V, I_D = 37A$		0.028	0.034	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15V, I_D = 37A$		40		S
$C_{iss}$	Input capacitance	$V_{DS} = 25V, f = 1 \text{ MHz},$ $V_{GS} = 0$		3260		pF
$C_{oss}$	Output capacitance			640		pF
$C_{rss}$	Reverse Transfer Capacitance			110		pF
$Q_g$	Total gate charge	$V_{DD} = 160V, I_D = 75A,$ $V_{GS} = 10V$ (see Figure 16)		84		nC
$Q_{gs}$	Gate-source charge			18		nC
$Q_{gd}$	Gate-drain charge			34		nC

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

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 100V, I_D = 37A$ $R_G = 4.7\Omega, V_{GS} = 10V,$ (see Figure 15)		53		ns
$t_r$	Rise time			33		ns
$t_{d(off)}$	Turn-off delay time			75		ns
$t_f$	Fall time			29		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	$I_{SD} = 75A, V_{GS} = 0$			1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 75A, V_{DD} = 100V$		222		ns
$Q_{rr}$	Reverse recovery charge	$di/dt = 100 A/\mu s$		2.18		$\mu C$
$I_{RRM}$	Reverse recovery current	$T_j = 25^\circ C$ (see Figure 20)		19		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 75A, V_{DD} = 100V$		267		ns
$Q_{rr}$	Reverse recovery charge	$di/dt = 100 A/\mu s$		3		$\mu C$
$I_{RRM}$	Reverse recovery current	$T_j = 150^\circ C$ (see Figure 20)		22		A

1. Pulse with limited by maximum temperature
2. Pulsed: pulse duration = 300 $\mu s$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area for TO-220 / D<sup>2</sup>PAK

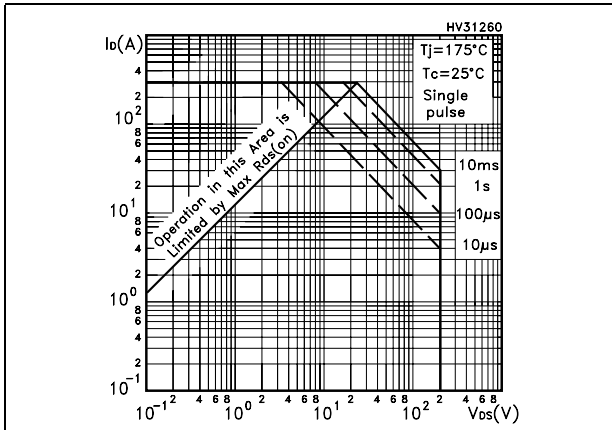


Figure 2. Thermal impedance for TO-220 / D<sup>2</sup>PAK

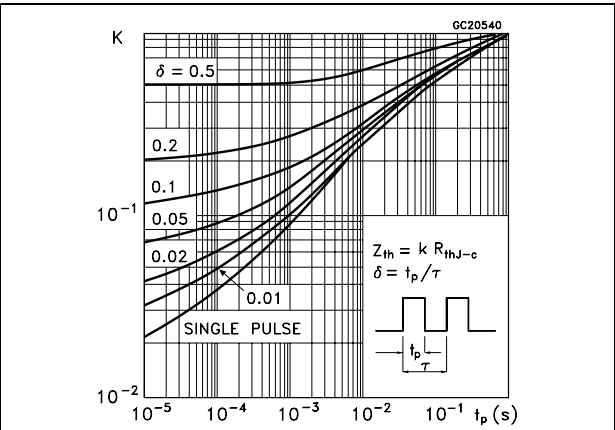


Figure 3. Safe operating area for TO-247

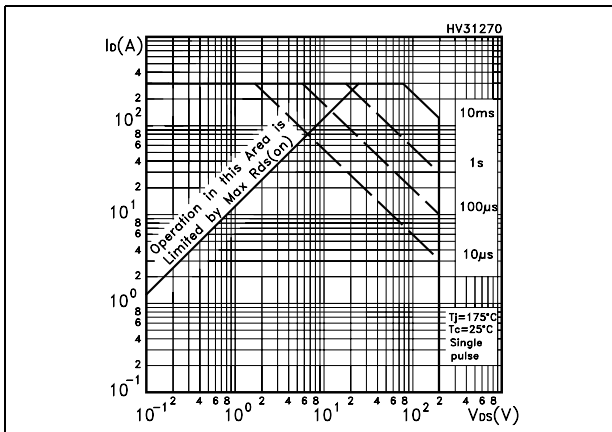


Figure 4. Thermal impedance for TO-247

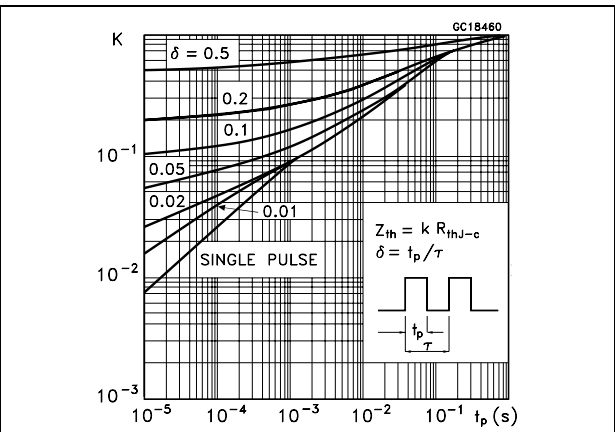


Figure 5. Output characteristics

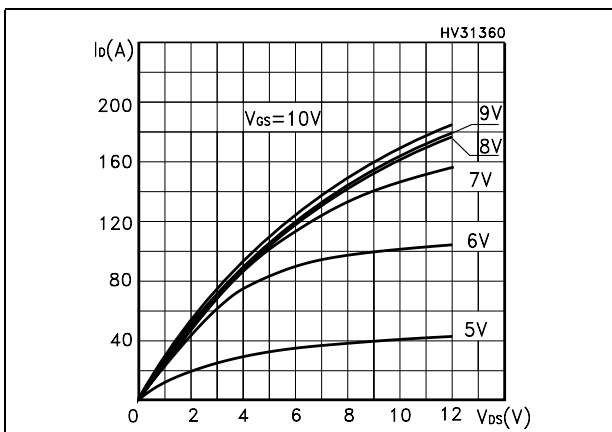


Figure 6. Transfer characteristics

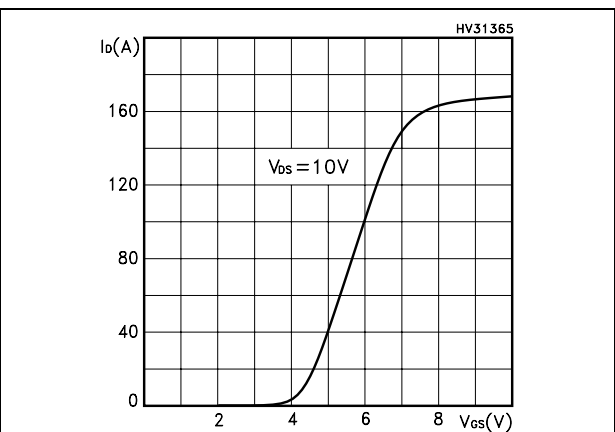


Figure 7. Normalized  $B_{V_{DS}}$  vs temperature

Figure 8. Static drain-source on resistance

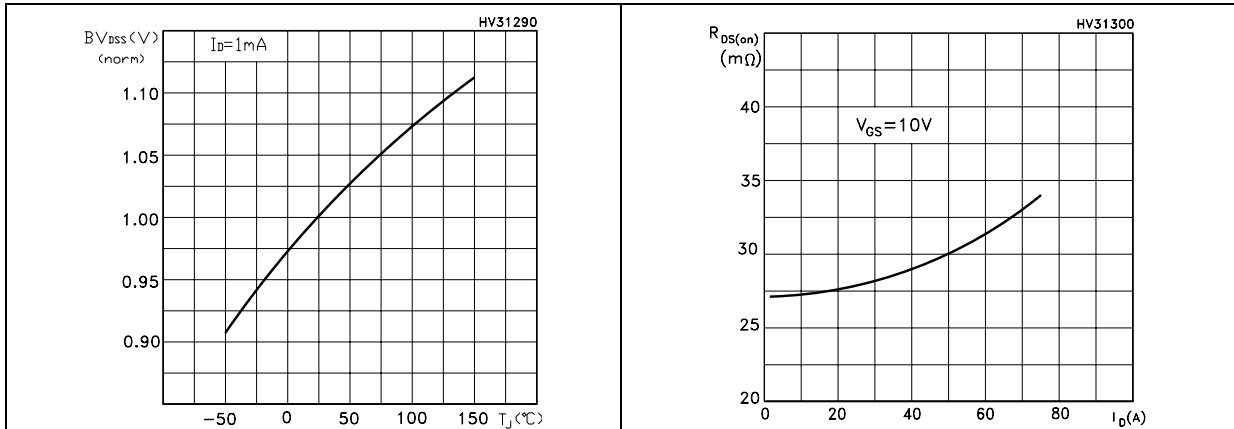


Figure 9. Gate charge vs gate-source voltage

Figure 10. Capacitance variations

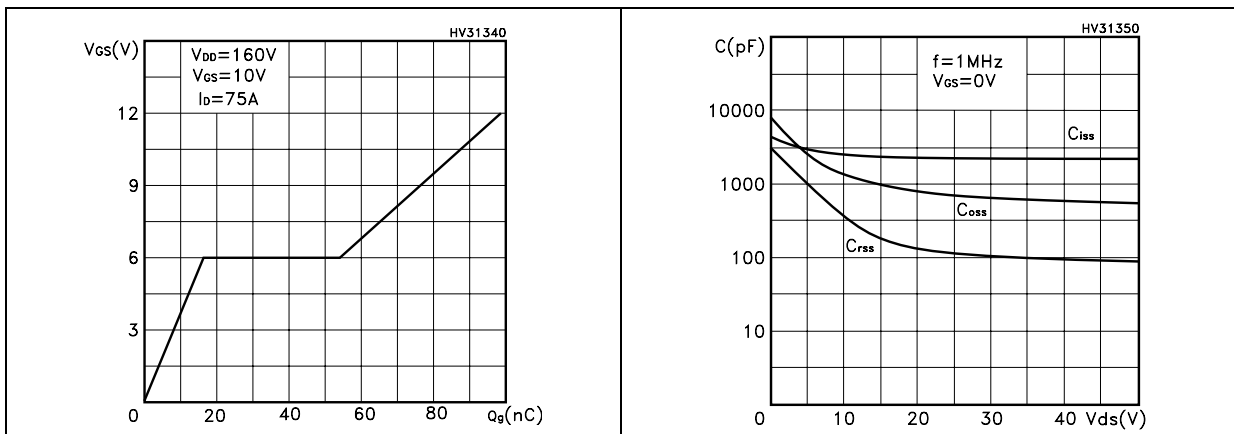


Figure 11. Normalized gate threshold voltage vs temperature

Figure 12. Normalized on resistance vs temperature

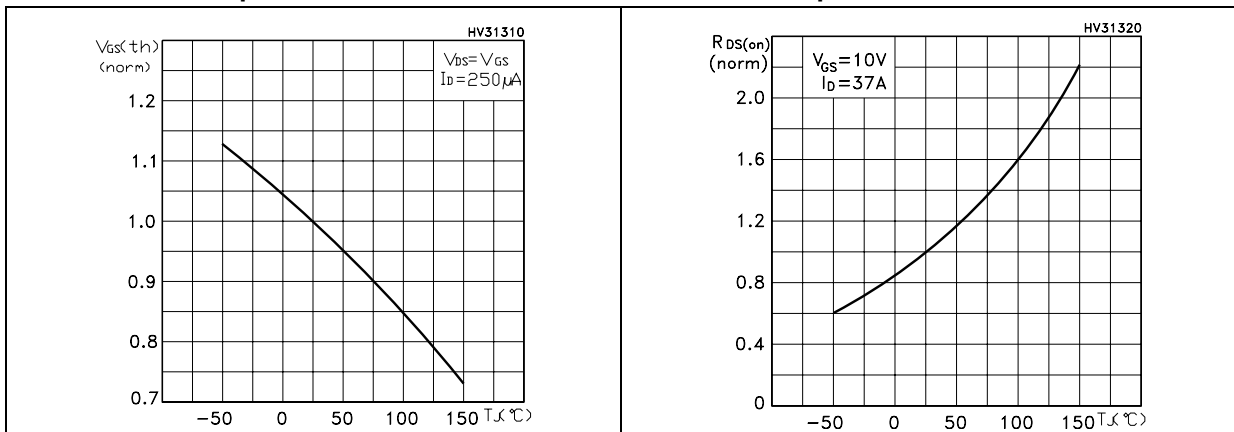


Figure 13. Source-drain diode forward characteristics

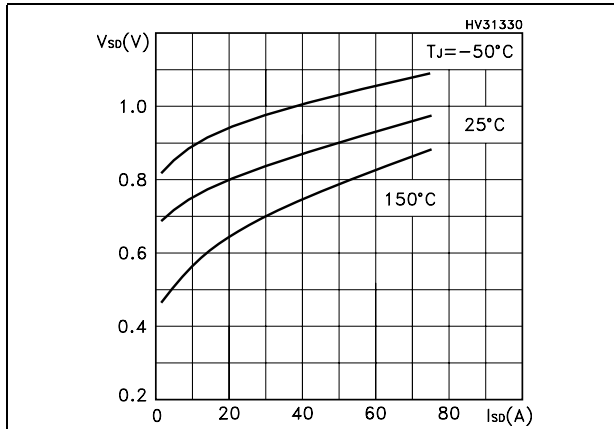
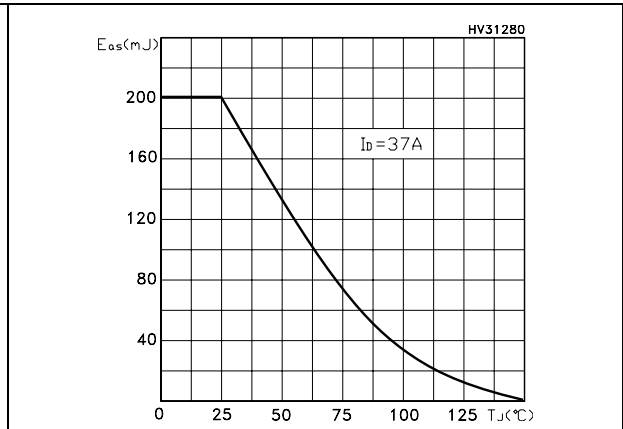


Figure 14. Avalanche energy vs starting  $T_j$





### 3 Test circuit

Figure 15. Switching times test circuit for resistive load

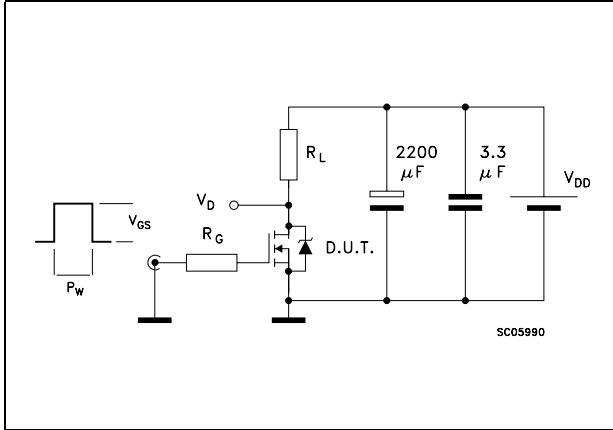


Figure 16. Gate charge test circuit

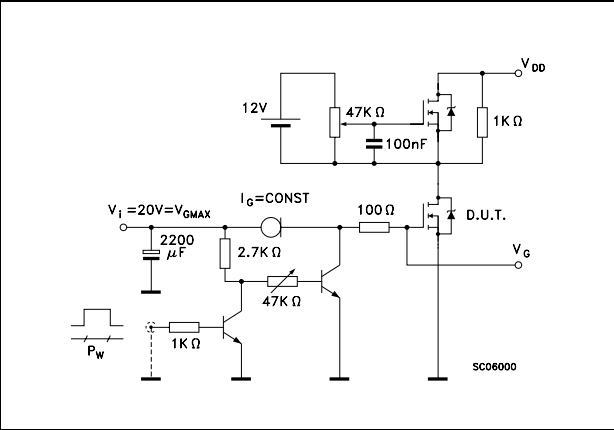


Figure 17. Test circuit for inductive load switching and diode recovery times

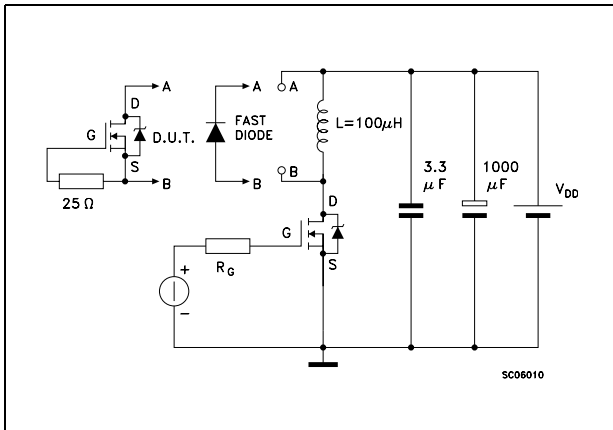


Figure 18. Unclamped inductive load test circuit

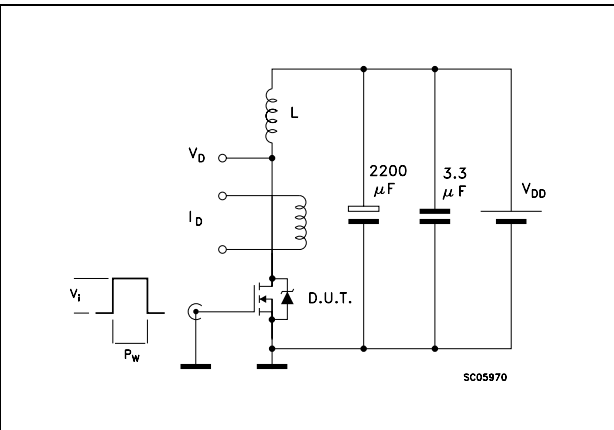


Figure 19. Unclamped inductive waveform

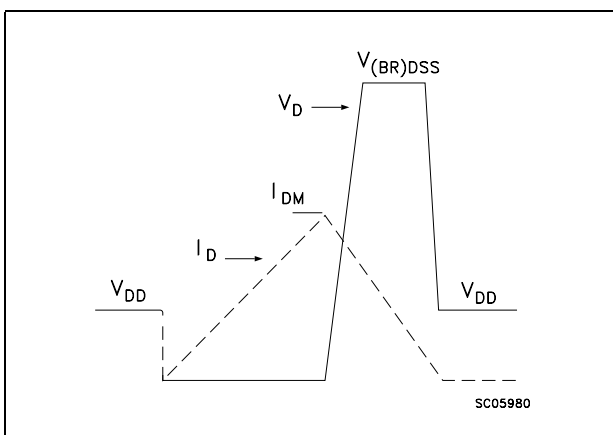
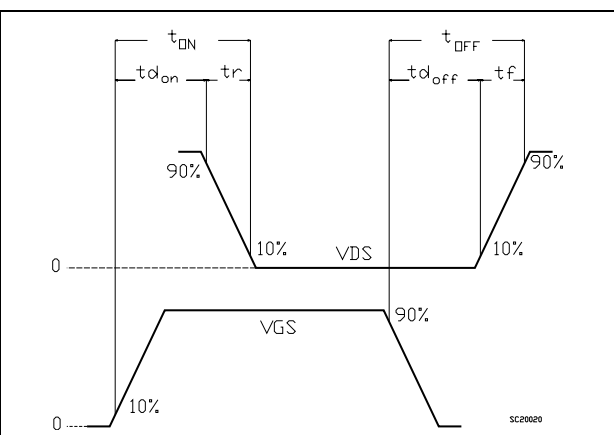


Figure 20. Switching time waveform

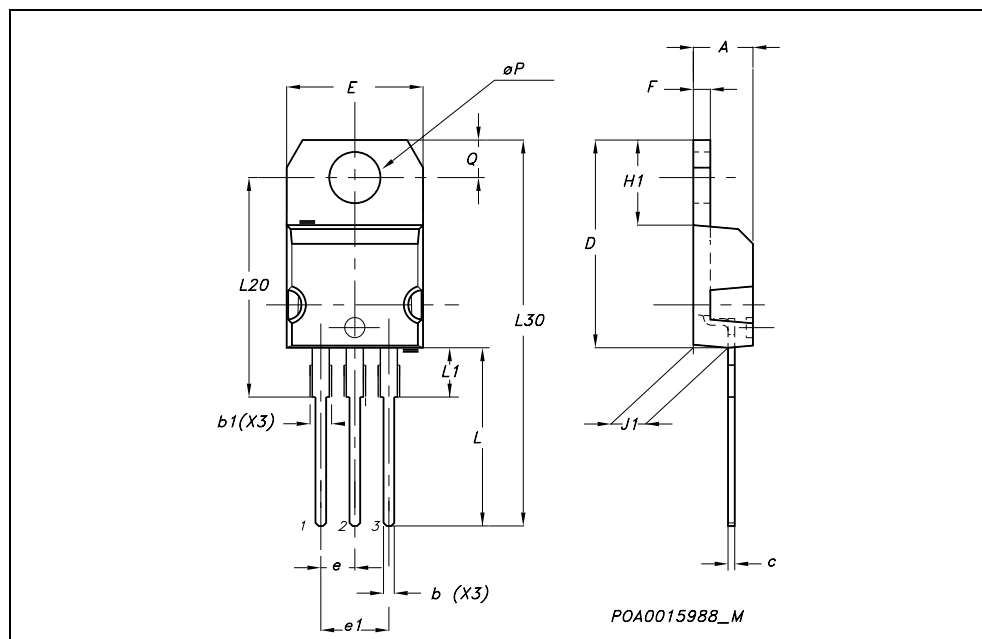


## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

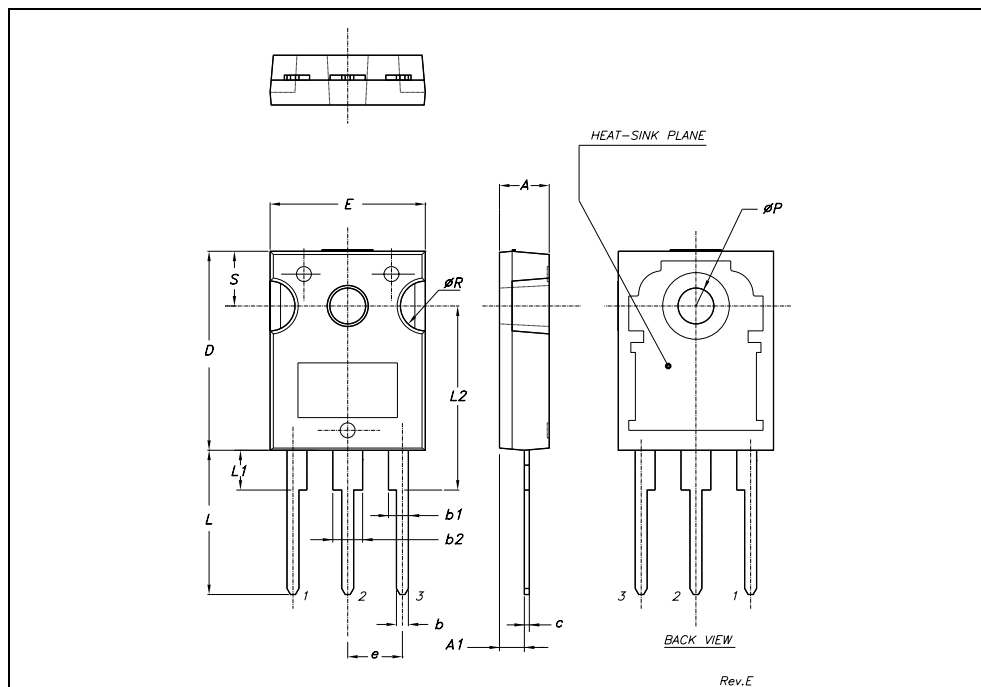
## TO-220 MECHANICAL DATA

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



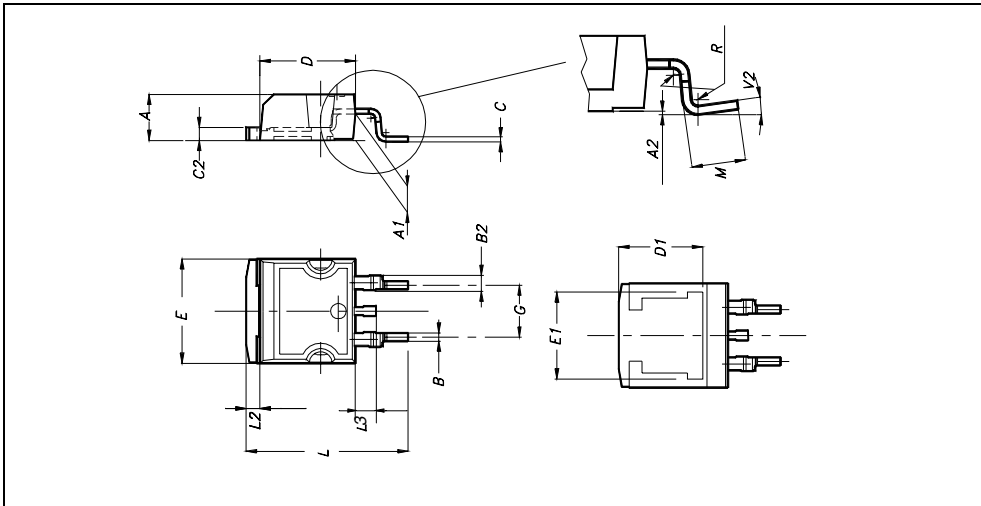
**TO-247 MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
A1	2.20		2.60	0.086		0.102
b	1.0		1.40	0.039		0.055
b1	2.0		2.40	0.079		0.094
b2	3.0		3.40	0.118		0.134
c	0.40		0.80	0.015		0.03
D	19.85		20.15	0.781		0.793
E	15.45		15.75	0.608		0.620
e		5.45			0.214	
L	14.20		14.80	0.560		0.582
L1	3.70		4.30	0.14		0.17
L2		18.50			0.728	
øP	3.55		3.65	0.140		0.143
øR	4.50		5.50	0.177		0.216
S		5.50			0.216	



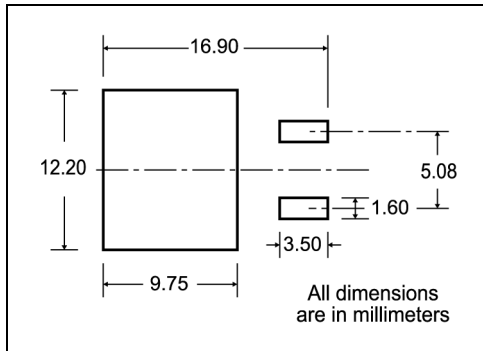
**D<sup>2</sup>PAK MECHANICAL DATA**

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

## 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

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

User Direction of Feed

FEED DIRECTION

Bending radius R min.

\* on sales type

## 6 Revision history

**Table 8. Revision history**

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
08-May-2005	1	First release
28-Mar-2006	2	Preliminary version
19-May-2006	3	Complete version with curves
19-Jul-2006	4	New template, no content change

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